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EDITORIAL NOTES.

A Well-Merited Honour.

NOTHING could have given us greater satisfaction than is experienced to-day in being able to open the pages of the "JOURNAL" this year with the heartiest felicitations to the leader of the gas industry and profession upon the honour that, with the New Year, His Majesty the King has been pleased to confer upon him. The satisfaction that we feel, we are sure, is universal in the gas industry—not only at home, but abroad; for throughout the gas industry of the world, the name of Corbet Woodall has for very many years been known and revered. The distinction of knighthood is, in this instance, one that is richly deserved alone for personal qualities and work; and yet Sir Corbet will forgive us saying that the men of the gas industry will be disposed to regard the personally conferred honour as being at the same time, under the circumstances of this and last year, an honour for the gas industry. We shall henceforth remember that the first year of the second century of gas supply under statutory powers and the Jubilee year of the Institution of Gas Engineers coincided with the bestowal of this distinction upon the President of that body, and of the British Commercial Gas Association, and the Society of British Gas Industries. We shall also associate the distinction with the centenary celebrations of the Gaslight and Coke Company, over which the Governor presided with so much grace and *bonhomie*, not unmixed with the well-known native earnestness. A stronger concurrence of events in the gas industry in which one man was and is the central figure there could not possibly be; hence the appropriateness of the time at which the honour of knighthood falls.

Of Sir Corbet Woodall's personal qualities, we really need not say anything in the gas industry; but thoughts cross the mind, and the occasion justifies brief expression. Sir Corbet was at one time in the official rank-and-file of the gas industry; and as such, and in those days, he was always distinguished for the varied gifts with which he was endowed, and which so eminently fitted him to be an administrator and leader in the industry in the widest sense of the terms—an administrator of affairs both technical and commercial, and a leader and governor of men. Those talents, combined with an amiability and a diplomacy inseparable from his nature, have carried him step by step from official rank to a plane higher than which it would be impossible to mount in the industry. It is a boast (we heard Sir Corbet himself make it to the officers, high-placed and subordinate, in the Gaslight and Coke Company only a few months since) that there is no work which any officer of a gas undertaking is engaged upon, that he himself, in his official days, has not—in some degree, and under the conditions of the earlier times—performed with his own head and hands. To this comprehensive exercise of talents possessed has been partly due the qualification that has enabled Sir Corbet to be what he has been in the service of the gas industry, at home and abroad. The reward, whatever its nature, has been the due entirely of personal and persistent work and oftentimes self-sacrifice—work based upon a constructive policy consistent with moving needs and changing times. That policy has included a beneficent consideration for those who work in life's ways with less responsibility and influence, and the brightening of which ways depends so much upon the encouragement given by others. We know (we ask no leave to refer here to matters of this kind within private knowledge) of work done among the poor of Woolwich in years long since by an ardent band of workers, one of whom was fortunately left behind by Sir George Livesey, among other staunch and longer adherents to the cause, to preach the gospel of co-partnership, and to bring its principles, through his powerful influence, to bear on a perfect army of workers. The characteristics of the leader of the industry upon whom the King has been pleased to confer knighthood are many; and his innate qualities and talents have indeed been exercised in a manner that has yielded excellent and widespread results.

Most men who attain to an eminence in the world's affairs attract critics to themselves and their doings; but not many men in exalted position can claim that they have fewer hostile critics than Sir Corbet. Hence we are to-day able to write, with full consciousness of the truth of the words, that many friends near, and many friends far away, rejoiced on New Year's day and since to find the name of Corbet Woodall inscribed on the national roll of honour.

Protection Work.

THERE has been no matter for a long time in gas legislation of such prime importance to the gas industry as the contest which was undertaken at the very outset of the enterprising action of the chemical manufacturers, and serious action for the gas industry, to place, by parliamentary enactment, the markets for the purchase and sale of the liquid residuals of gas production and for spent oxide under the domination of the chemical trade. Had there not been bodies such as the Gas Companies' Protection Association and the Institution of Gas Engineers to take the initiative on behalf of the gas industry, the position would have been a grave one for the latter. These bodies early saw the necessity for a resistless struggle to change the trend of events; and there was co-operation between them. But in the struggle, the Gas Companies' Protection Association, as the more independent body, and as the only body in fact organized for the express purpose of protecting and promoting the rights of gas enterprise, stood in the forefront. One of the lessons of this attack on the gas industry by external trading interests and the defeat produced largely by the action of the Association, is that the Association must be made as effective as it is possible for the gas companies of the country to make it. The only way to accomplish this is for every gas company in the United Kingdom to become directly identified with it. Every gas undertaking is indebted to the Association particularly for what has been done on this occasion, and generally for the results of its watchfulness, intervention, and initiative in the past in connection with many legislative matters. Its existence has now been more than justified; as a matter of fact, had the Association not been in existence at this critical time—and it is for critical times that such an operative organization must be maintained in times of peace—the gas industry would have felt keenly that there was something wanting in its power for self-preservation and protection.

The Association is recognized by the parliamentary and

other public authorities as a representative body of the gas industry. It was the Association recognized by Parliament as the proper representative of the industry in the recent presentment of its case before the Joint Committee; and on many occasions Government departments have granted interviews to, and had consultations with, the Association as representative in legislative matters of a large national and public-serving industry. The most should, therefore, be made of the Association, by rendering it wholly representative of the units of private gas enterprise, as it is to-day (within the sphere of its operations) representative of the major part of the capital of private gas enterprise. In this connection, there is a point that should not be overlooked. It is one of the features of modern constructive gas policy for undertakings to amalgamate, and for the larger and more economically worked concerns to secure territorial and opportunity expansion by the annexation of smaller concerns—thereby, at the same time, conferring advantage upon the community in the annexed area. This movement has its effect on an organization of the character of that of the Gas Companies' Protection Association, whose membership consists of undertakings and not of individuals. In view of this movement, as well as to increase the effective power of the organization for prompt and large action, it must be continuously reinforced by fresh subscribers. This is very necessary; and no time is more opportune for pressing this home when the gas industry stands face to face with the complete repulse of those who sought, for their own private gain, to interfere with, and to obtain an absolute power over, the purchasing and the selling markets for the liquid residuals and spent oxide of gas-works. We hope that the occasion will be recognized as one that urges with force the importance of maintaining and strengthening such an important factor in the protective work that is essential, and as in this instance that is exigent in character, in an industry such as gas supply—an industry whose interests are exposed to attack on every side. Vigilance for the opportunity to attack these interests is closely maintained outside its own bounds. Twelve months ago we were not expecting such an attack on the part of the chemical manufacturers. It soon came, however. There was success by the aggressive party at first; and everything in connection with it appeared to be turned against the gas industry. The whole face of the position has been permanently and effectually changed; and there is large indebtedness for this by all gas undertakings (for all are bound at some time or other to be in Parliament) to the Gas Companies' Protection Association.

It is therefore due to both the victory and the Association that the projected Joint Bill shall be promoted with the names inscribed upon it of all undertakings with the residuals restriction in their Acts or Orders. It is due to the Association that they should henceforth be able to claim that their membership roll includes all the gas company undertakings of the British Isles. It is not a dignified position for any gas undertaking, whatever its status, to be the recipient of benefit for the securing of which they leave other undertakings to find the funds. If their policy was followed by all gas companies, where would the gas industry be in these times? What would be the effect upon those concerns that abstain from helping, in accordance with the degree of their commercial magnitude, the protective work for which the Gas Companies' Protection Association solely exists? Let this question be well pondered and conscientiously answered; and, if this be done, we know full well that there will soon be a substantial lengthening of the roll of the Association. This may be added as a final word, that it is no part of the duties of the Association to pick quarrels with anyone; its functions are to watch and to intervene whenever necessary. In fulfilment of its objects, the Association has on this occasion worked with brilliant effect.

Gas Bills—The "By Them" Restriction.

THE work of Parliament now trespasses upon time far beyond what was but a few years since regarded as normal; and this session is the most abnormal in length within the period during which most of us have taken interest in matters political. The session started early the second week of February last year; and it looks as though it is going to belate the commencement of the new session. Whatever happens, there cannot possibly be any great break between the two; and our legislators will have to pass from the affairs of the one to those of the other with a short step. The gas industry is not likely to claim much time at the hands of those dealing with Private Bills, as the number of measures to be dealt with is not very great, and a cursory examination does not reveal anything likely to be very contentious. There are certain Bills which are important, and which will extend the operations of the concerns into new territory and into (for them) a fresh line of business. But, with few exceptions, the Bills are not weighty, nor do they involve anything much that cannot claim precedent.

In to-day's issue we start the review of the Bills by dealing with those of companies seeking for incorporation and parliamentary status and powers. There are only five of these companies in Parliament for the first time; and there are merely two or three points about the Bills that are worth special mention. The first one is very important; and it is not a little surprising that there should be any occasion to call attention to it. Immediately the Model Clauses were published for the coming session, promoters were strongly urged in our columns not to adopt the words "by them" that had been introduced into the general purposes and works clauses, or any form of the "chemical "clause," as such a proceeding on their part would imply tacit acceptance of the principle of restriction in their dealings in residuals to those produced in the manufacture of gas solely by the company concerned. But what do we find now that the prints of the Bills are before us? In the group of measures under review to-day, the new models of the general purposes and works clauses have been followed, and the limitation of business in residuals is proposed to be imposed through the words "manufacture, convert, and sell all "residual products resulting from the manufacture of gas "*by them*," and the "by them" is again repeated in the works clause. Glancing through the Bills that will come under review in subsequent issues, we find among the statutory companies' measures that the Redcar Gas Company have also the "by them" restriction in the works clause. In local authorities measures, the same limitation is found in the Brumby and Frodingham District Council Bill and in that of the Windermere Council.

It is difficult to understand just why this has been done, unless it be that those who drafted the Bills have not been aware of the contest of the gas industry with the chemical manufacturers, and of the full import of the restricting words. The alteration of the model clauses in this connection was distinctly premature, in view of the appointment of a tribunal to consider thoroughly and to determine once for all the point at issue; and upon that premature act the blame must be laid for the change from the old form of clauses in the draft Bills mentioned. The decision of the Joint Committee having been in favour of the claim of the gas industry, that it should not be deprived of liberty in its dealings in residuals, those concerned in the promotion of the Bills into which the restricting models have been copied should take the earliest opportunity of having the clauses modified, not only by the deletion of the words "by them," but by a reversion to the old models which give full power to "deal in" gas residuals. Those concerns upon whom the restriction was placed during the Private Bill work of 1912 are now taking counsel together regarding the promotion of a Joint Bill for the purpose of annulling the mistaken and mischievous limitation; and the administrators of no gas undertaking should voluntarily allow the concern whose fortunes are largely in their hands to be placed under the objectionable disability. The Bill of the South Staffordshire Mond Gas (Power and Heat) Company does not propose that any such restriction should be placed on their residuals dealings. They are wise—as wise as the Free Traders of the House of Commons who worked for protected buying markets for the chemical manufacturers and restricted selling markets for gas undertakings.

Among other interesting matters in the group of Bills before us, we see that—like the Morley Corporation—the Porthcawl Company are proposing to adopt calorific value as the standard of quality, in place of illuminating power; the clauses referring to the change being on the lines of the South Suburban ones [Oct. 15 last, p. 220]. The promoters mentioned are the first who have in Bills as lodged superseded illuminating power by calorific value as the standard of quality. The Ely Valley Gas Company are asking for 12 candles as the standard of illuminating power. The favourable position that gas companies occupy for economically meeting such demand as may exist for a supply of electricity where the ground is not already covered, is being taken

advantage of by some of the companies whose measures are under notice to-day, and who operate in rural areas. Reflected in the Bills, too, we see the aversion of the public to low fixed interest and dividends on preference and debenture stocks, while secure higher dividend can be realized on ordinary stocks in sound and well-established concerns. On preference stock, 6 per cent. is pretty generally named in the Bills. This means dearer capital.

Government Officials and Gas Lighting.

THE gas industry, as a large rate and tax payer, as a large employer of labour, as a large spender of money in many industries of the country, has cause of complaint regarding the action adverse to its interests of certain Government officials. The Board of Trade has decided that, in labour exchanges, "the electric light should be installed wherever "available throughout the country." This was the information conveyed to readers by a paragraph in last week's issue; and it was the information conveyed to the chief officer of a gas undertaking in the North of England in reply to a communication from him to the Board as to the lighting of a labour exchange. The gas industry has a perfect right to know the reason for this autocratic proceeding. It is not the first time that attention has been called to it. Similar complaint was made as to the high-handed action on the part of Government officials, by Alderman Thomas Canning, at the last meeting of the Wales and Monmouthshire Institution of Gas Engineers; and it is time that a protest should be made in a more emphatic and effective way both through the representative bodies of the industry, and through members of Parliament who are interested in the welfare of the industry. The treatment over which the gas industry has a genuine grievance is not the due of large rate and tax payers; and the industry ought to be protected against any personal preference on the part of Government officials, unless they can show good and unassailable reason for the preference. Government officials are the servants of the country, and not of the electric light industry, whose interests they seem particularly inclined to favour. The scales should be held by them fairly between the two industries; and Government departments, as well as all public authorities, ought, in matters of this kind, to arrive at a settlement on competitive tendering for light of a given value, and not decline to invite and consider offers from one of the two competitors, and the one unfairly treated the older servant of the community, and the larger rate and tax payer. The gas industry should make a serious attempt to get at the bottom of this matter, as there can be little doubt that the Government officials concerned have not given the question full and independent consideration.

It would be interesting if we could obtain from the Board of Trade officials some indication as to the reasons for the favour they are showing, as then the matter could be discussed with them upon a proper basis. As it is, the gas industry is absolutely in the dark respecting the motives that have led to the total denial to gas lighting of entry as the illuminating agent in labour exchanges. Is the decision founded on some false notions as to the economy of electric lighting? If so, let competitive tenders for installation, and the provision of a definite light for a given number of hours, settle that point. Or is it that the Government officials are of opinion that the electric light is safer than gas? If so, consider the recent outbreaks of fire at the Home Office, at the British Museum, at various large drapery establishments, and at numerous other places where the fusing of electric wires has brought about total destruction of property, and in several cases loss of life. Is it that the electric light is considered to be more reliable than gas lighting? If so, consider the numerous failures of supply that have recently taken place. A long list of such failures can be supplied by us, showing collapses of supply, large and small, all over the country. Is the decision based upon any belief as to the superiority of the metallic filament lamps in relation to eyesight? If so, let the Government officials study the relative intrinsic brilliancy of metallic filament lamps and inverted gas-burners, and also see what ophthalmists have to say on the subject. The views of one authority appear in this issue of the "JOURNAL;" and the views of many others can be furnished if the Government officials really want seriously to inform themselves on the point. Mr. A. P. Trotter, the Electrical Adviser to the Railway Department of the Board of Trade, can, if he chooses, give the Government officials concerned a large amount of interesting matter bearing upon the subject. He can tell them how he personally objects to the metallic filament lamp on account of its eye-injuring high-intrinsic brilliancy, and prefers to work with the lower intrinsic brilliancy carbon filament lamp. Where Mr. Trotter uses metallic filament lamps, he prefers indirect illumination, by shading the lamps in front, and having reflected light from the walls. For adequate illumination, that is a much dearer system than obtaining illumination from the inverted gas mantle, the intrinsic brilliancy of which is lower even than that of the carbon filament lamp. If on all these points the electric light possessed merits superior to incandescent gas lighting, then the gas industry could understand the attitude of the Government officials in proscribing gas lighting in connection with the labour exchanges throughout the country. But the contrary being the case, there is certainly reason in our inquiries.

Now of all offices under Government control, gas should have preference in labour exchanges. Per unit of commercial work, the gas industry gives far more employment to labour than the electrical industry; and the gas industry in the winter time largely increases that employment. In the homes of the poor, too, throughout the country, the gas industry has improved the domestic conditions through the prepayment meter system, whereby better lighting and better facilities for cooking and heating have been introduced into them. On these grounds alone, if for no others that have been advanced in this article, gas lighting has claim upon the officers of the Government and of the country for fair and unprejudiced consideration in the matter to which we now specially call attention.

The Waste Heat of the Gas-Oven.

THE types of gas-cookers in general use have held sway for a long time without any material improvement other than has been provided by the changes effected to assist in keeping the whole of the fittings in a clean and efficient condition. There is one point that has not received the attention that it deserves. B.Th.U. are cheap in the gas industry; and mainly due to this is the fact that, except in a spasmodic sort of way, no serious attempt has been made to utilize the waste heat of the gas-oven. Attention has occasionally been drawn to the utilization of part of the waste heat in warming plates, keeping food hot, and so forth. But the service of the waste heat has ended there until somewhat recently, when attention began to be directed to the utilization of a portion of the waste by transferring the heat from its wayward course to the definite and useful function of raising the temperature of water. To apply any form of waste to a useful purpose usually, but not always, means economy; and if the convenient, and not now costly, gas-oven can be made more economical still by the utilization of some of its waste heat, so much the better. We believe that it can be under certain conditions. But there must be a care; and it is essential there should be a judicious rate of proceeding in this particular matter (current conditions in regard to the number of gas-cookers in use will assure this), in order not to jeopardize the prospects of any gas-oven that may be perfected to the efficient performance of the dual duty. If such an oven can be (one may already have been) produced—an oven that will bake and simultaneously supply hot water at a less additional expenditure of gas than would be required to heat the same volume of water independently—then the old complaint that the gas-oven has the disadvantage, in comparison with the boiler-fitted coal range, that it does not supply hot water when in use, will no longer hold good.

The workers, as we have seen in our pages and elsewhere lately, are labouring at the problem. A short article recently appeared in our columns showing what one inventor had done. There is a more extensive article to-day describing what another worker has accomplished, and giving the results of a number of temperature tests, supplied by the experimenter, with and without cooking proceeding in the oven. When considering this article, a few general points suggest themselves, quite irrespective of any claim (which we cannot make) to experience with a combination cooker and water-heater. Water heating can now be done so very cheaply and expeditiously by boilers, geysers, and other means, that there must be, to secure favour, some definite economy shown by the combination, and an economy obtained without—this is most important—detriment to the primary duty of the gas-oven. Water cannot be heated

to any considerable extent with a combination cooker upon waste heat alone. The water provides something beyond the casing of the oven to extract heat; and, in the process of heat absorption by the water, there must be some additional consumption of fuel. The measure of the extra consumption depends on the type of the water-heating arrangement, and how it is fitted. It may be, on the average, more than would be consumed by providing by some other means the quantity of hot water that is required for "washing-up" and other purposes within the time that the gas-oven-provided water would remain at a sufficient temperature for effective use after the gas had been extinguished in the oven. Supposing provision be made in the gas-oven for heating 20 or 24 quarts of water, it is not always that this amount would be needed; and yet the volume of water provided for in the gas-oven water-heating arrangement (which water is always at a lower temperature than the oven when in use) would all be absorbing heat whatever small or large purpose the oven was being put to. Take the case of the oven being required merely for the purpose of baking a cake, or a fruit tart. The consumption of gas would then, we take it, be greater through the heat extracted by the water than would otherwise be the case.

That is one point; but the more important is that the water heating shall not affect the primary purpose of the gas-oven. If a volume of water is being heated round an oven say, in the shape of a water-jacketing, it seems to us that this must somewhat retard the initial temperature in the oven; and we can also see the danger of water being drawn off, and a fresh feed of cold water being given to the water-containing vessels during the cooking operations, which again suggests variable temperatures in the oven. In the case of the patented invention applied to the "Seal" gas-oven, which is the subject of the article in other columns, there is one form in which the water in the pad on one side of the oven can be drawn off, and the pad be re-fed, while the hot water remains in the other side. This again suggests variable temperature if such a proceeding took place during baking. These, we repeat, are all only *primâ facie* suggestions. It may be that the heat transfer is so slow, even with the complete displacement of hot water by cold, that the effect would be inappreciable; and yet we cannot help feeling that the chilling of the side or sides of the oven would be felt internally, when perhaps least desirable. In one of the forms of waste-heat intercepting pads described elsewhere, with connection between them, the water-feed is from an overhead tank to the bottom of the back pad; and in this case the chances of changes of temperature in the oven through the drawing off of hot water must be greatly diminished.

In one or two instances of gas-oven water-heating proposals that have come before us, the water-containing elements are placed inside the oven. We can imagine in such cases that the effect on oven temperature would be greater than with outside fitted pads in the event of changes from hot to cold water during cooking, if any large body of water was drawn off. If the water-heating element, too, is placed inside the top of the oven, and hot water is displaced by cold, there might be condensation, which would not be an improvement in the oven conditions during (say) the baking of pastry. Pastry does not by any means require any increase in the humidity of the oven. Copper coils, too, would be objectionable in such circumstances; and iron ones, we fancy, would soon rust under such conditions. It is remembered, too, that a few years ago there was a design for gas-oven water heating in which flue-heat was utilized; but we should be rather suspicious of the effect of the sudden cooling of the products in the event of water being drawn and cold water being admitted to the heating arrangement. However, these are only ideas that occur on considering the matter generally, without any experience as to what actually happens under conditions of which those only who have made experiment can speak definitely. If anyone who has had experience can add to the interest of a subject that possesses novelty and possibilities, we shall be very pleased indeed to hear from him.

The article in other columns, which has been composed from communicated information, contains the results of several temperature experiments in water heating by waste-heat intercepting pads. Consumptions and temperatures are compared with and without food in the oven; temperatures top and bottom in the "Seal" oven are compared with top and bottom temperatures in an ordinary oven (the build of the latter is not described); and another interesting point is the experiment figures showing a rise in temperature of the water in the pads after the gas-flames had been turned out. This is attributed to the fact that, in the "Seal" design, the oven is completely closed in, and, when the gas-flames are extinguished, by shutting the ventilators and the air apertures through which the flames are fed, no cold air at all can circulate in the oven or the flues, and so the water-pads get the benefit of the heat contained in the structural parts between the water-pads and the interior of the oven. The whole subject, we are sure, will claim interest. If general economy can be shown by which a good supply of hot water can be procured during the use of the gas-oven, and if the water can be drawn-off while the oven is in use without detriment to oven temperatures, then there is certainly a place in the gas industry's progressive work for this useful development.

Depreciation and Income-Tax.

It seems to be overlooked that the scheme of depreciation allowance in respect of income-tax entered into by representative gas companies was in the nature of a compromise with the Inland Revenue Authorities, and has never been put forward as perfect. It was the best that the gas companies could get, to save endless litigation and friction with the authorities. If this is remembered, the futility of criticism of the scheme will be seen, seeing that no one in the gas industry accepts it as anything more than it is—the best that could be arrived at under exceedingly awkward circumstances. From the Institute of Municipal Treasurers and Accountants, there comes a report by the Council on the subject; and the Council do not like the gas companies' scheme so well as their own original one. They are of opinion that the gas companies' scheme would be of doubtful advantage to municipal undertakings. If municipal undertakings think so, then let them adhere to their present scheme. There are points in the report of the Council with which we agree; there are points with which we disagree. They consider that the allowances provided for relate only to items of "minor outlay" except as regards gasholders. We hardly think the Council have fully considered what is covered by the term "minor outlay." If they will take account of the actual expenditure on meters (ordinary and prepayment), cookers, and gas-fires, in relation to the whole capital, we think that they will find that the sum of this expenditure calls for a stronger term than "minor," and that, having regard to this sum and to the life of the subjects, the 10 per cent. allowance is not a thing to be despised.

The Rigidity of the Allowance.

There is something to be said for the Council's view as to the inelasticity of the allowances; but if depreciation allowances are required, there must be some settled basis for different subjects. To agree to a limited wear and tear allowance for depreciation, the Council contend, involves the denial of any allowances for past wear and tear, and also of all future renewal charges. There is point in this, as is confirmed by the stipulation in the gas companies' agreement that in all cases where depreciation allowances are granted, renewals, if charged against revenue, must be carefully distinguished and notified to the surveyor, in order that the amounts so charged may be added to profits for the purpose of arriving at income-tax liability. This therefore denies all right, in cases where there is depreciation allowance, to further allowance on charges to revenue for renewals of the same subjects, whether the depreciation allowance is sufficient for the purpose or not. At the same time, we do not like the principle of only charging renewals as and when expenditure is made; believing that the putting by for renewals while depreciation is being incurred, and while the depreciating subject is earning money, is the proper policy to pursue—depreciation allowances, of course, being adequate. But such allowances are generally inadequate, and it would be a welcome compromise, and the perfect scheme, if the Inland Revenue Commissioners could be persuaded to allow depreciation, and to make a periodical adjustment between it and actual expenditure on renewals. The Council of the Municipal Treasurers and Accountants would like this; we should all like it. But the unfortunate thing is we cannot get all that is desired from the Commissioners. For what gas companies have received, they must for the present be thankful. An opportunity may arrive later for a revision of the terms.

A Bad Ending and Start.

Rarely does the electricity supply industry get through Christmas time and enter upon a new year without something to disturb its peace of mind. A few of the happenings of last week are interesting and publicly instructive. Drapery store owners were again reminded of the danger existing in electrically-lighted drapery premises, as they have been too frequently to be pleasant. This time the reminder came from the establishment of Messrs. Harvey, Nichols, and Co., Limited, of Knightsbridge. Some 200 girls were asleep on the premises at the time the outbreak occurred; but fortunately they all escaped safely. A morning paper before us, reporting the details of the occurrence, says "the outbreak *was due* to the fusing of electric cables in the basement"—not is supposed, or reported, to be due, but "was due." Then late in the evening of New Year's Day, a fire occurred on the premises of Messrs. Mortlocks, Limited, china and glass manufacturers, of Oxford Street. The fire, the report states, "is supposed to have been caused by a defective electric circuit." Why should there not be an inquiry now—say, by Major Pringle or Lieut.-Colonel Sir H. A. Yorke—into the question of the danger of the use of electricity on business premises where there are a number of "sleepers-in?" The gas industry might hope to score here with judicial consideration and verdict.

Other Happenings.

A peculiar occurrence is illustrated by a boy who is lying in Sunderland Infirmary. He was playing in the street, when a piece of incandescent carbon fell from one of the electric arc lamps, and, as ill-fortune would have it, set fire to a celluloid collar he was wearing. There was a blaze; and the boy's neck and head were severely burnt before aid could reach him. Mr. John Christie, the Electrical Engineer at Brighton, had the comfort of his evening broken last Friday. He was delivering a lecture at the Brighton Pavilion when the light failed. On further investigation, he found he was confronted with a complete failure in the eastern district of Brighton and a partial one in the northern district. The lecture was interrupted while he transferred himself to the North Road works, where he found the source of the trouble. Besides private establishments, the Palace Pier and certain other places of entertainment were affected. At the Aquarium, where a band was playing, and at the Shelter Hall, where a variety company were performing, the ever-reliable gas was available. Such incidents have an educational and a commercial value, but unfavourable to electricity.

Position of Nitrate of Soda.

The increased attention which has of late been paid to nitrate companies would seem to have been fully justified, judging by the reports that are coming to hand. A greater proportionate increase in the consumption than in the production has led to the realization of higher prices, and among competent authorities a further rise of values is anticipated during the next six months. Summing up the position in their half-yearly report, Messrs. Montgomery and Co. point out that in the first six months of 1912 there was an increased consumption in Europe of 147,000 tons, and in the last half year of 65,000. This gives an increased consumption for the year of 212,000 tons, or 12·5 per cent.; the actual figures being 1,908,000 tons, against 1,696,000 tons. Consumption in America fell off; but other countries, including Egypt, show steady progression. After making all adjustments, it is seen that the world's consumption for the twelve months reaches a grand total of 2,504,000 tons, as compared with 2,355,000 tons in 1911. This is an increase of 149,000 tons, or 6·33 per cent. A number of figures are included in Messrs. Montgomery's report, which make clear the rapid growth that has occurred in the use of this particular fertilizer. The world's consumption for 1902 is put at 1,259,000 tons, as compared with the figure already mentioned of 2,504,000 tons for the twelve months just closed. This short period, therefore, has proved sufficient to practically double the consumption.

The Future and a Calculation.

The future of nitrate, in the opinion of this firm, holds out promise of a continuance of this satisfactory growth, inasmuch as the American consumption is still a very long way behind that of Europe; and thus progress in the consumption there should become much more rapid, while there are other parts of the world, too, in which a quickly expanding demand is looked for. As to prices, we learn from the report of Mr. Thomson Aikman that the average spot price per cwt., cost and freight, for 1912 was 10s. 1d., which was about 1s. 1d. higher than the average for the previous year; and he makes a calculation as to how this compares with the quotation for sulphate of ammonia. The world's production of the latter commodity, he says, is believed to have increased about 5 per cent., "and the price has averaged about 1s. per cwt. higher—to-day's level of price for next spring delivery making it about 3d. per cwt. cheaper than nitrate of soda per unit of nitrogen." Mr. Aikman adds that in the spring of 1906 and 1907 (the last occasions on which the supplies of nitrate were curtailed), the respective prices made sulphate about 1s. 3d. to 1s. 6d. per cwt. cheaper than nitrate per unit of nitrogen.

The Retreat of the Coal Fire.

The prejudice begotten by the old gas-fire has practically ceased to exist; and where it still has possession, it is being gradually swept away by the flood of experience. The truth as to heating and hygienic efficiency, and as to the remarkable effects that the supersession of the kitchen coal range and the domestic coal fire by gaseous fuel has had in lessening the dense and noxious form of fog, has penetrated to a large degree the public mind; and the result is the ever-increasing volume of business that the gas industry is doing in the heating line. Not only in London and the suburbs, but from cities and towns generally in the provinces, there comes the same tale of the swelling demand for the gas-fire and the gas-cooker; and never indeed has the demand been greater than it is to-day. More comfort at home, better atmospheric conditions, and a greater number of hours of sunshine, are the results of this progressive change, as sketched by Mr. W. G. Faulkner in an article in the "Evening News" last Friday. Mr. Faulkner was astonished by the results of his investigation, as must have been his readers. He finds that in London alone in the past nine months something like 90,000 gas heating and cooking stoves have been installed; and he further discovers that, within the knowledge of the London Gas Companies, 1,574,000 coal fires in their areas have been displaced by gas. This is a remarkable showing; and yet the gas industry considers it has only actually entered into possession of the border ground of the possibilities in this direction. Is it to be wondered at that the retail coal merchant and the chimney sweep do not at all like the cleaner and more rational method of utilizing the fuel that Nature has bestowed upon mankind?

A Good Instalment.

A largely attended meeting—the delegates numbered over 500, and represented about 2,000,000 workers—was held in London last week, for the purpose of considering the Trade Unions (No. 2) Bill. It was a special conference convened by the Joint Board representing the Parliamentary Committee of the Trades Union Congress, the General Federation of Trade Unions, and the Labour Party; and in explanation of the necessity for calling the meeting, it was pointed out that the Bill had been improved in Grand Committee, but not sufficiently to meet the demands of the Labour Party. It became necessary therefore to decide upon their final attitude towards the measure. The Committee added that it was obvious that the Bill did not fully restore to trade unions the right to engage in political action as a method of regulating the relations between employers and employed; and the unions must continue to assert the claim that, without political action, they could not properly perform this important function. But inasmuch as the Bill did allow trade unions to engage in political action under conditions which, though thought to be unfair, could nevertheless be made immediately operative, the Committee were of opinion that the conference would be "securing the immediate future of the political labour movement if they accepted the measure under protest, and regarded it as an instalment, and not as a final settlement, of labour's demands." This advice, after some plain speaking, the conference adopted by a large majority; and the decision cannot but be looked upon as a wise one, for the Bill must surely be regarded as a very good "instalment"—from the point of view of the trade unionists who are in sympathy with the political ideas of the Labour Party. Why should not those unionists who object to contribute to the levy for political purposes have the right of exemption suggested by the Government?

Coal Figures.

The complete figures regarding the output of coal in the United Kingdom during the year 1911, which have become available with the publication of Part III. of the Home Office Annual Report on Mines and Quarries, afford opportunities for making useful comparisons with regard to this great national industry. As was pointed out in the "JOURNAL" at the time of the issue of Part I. of the report, the total output of coal for the twelve months was close upon 272 million tons, which was an increase of nearly 7½ million tons over 1910—in fact, greater than in any previous year. In 1873 (the year to which the particulars go back) the output was about 130 million tons; and previous to 1911, the highest figure was reached in 1907, when the quantity of coal raised was in the neighbourhood of 268 million tons. This proved the climax to a strong upward movement which had extended over some years, and 1908 witnessed a falling off. This was, however, followed by a recovery in 1909; and this has since been continued. Comparing 1911 with 1910, it is seen that the increase in the value of the coal raised is not quite in proportion to the increase in quantity, owing to the fact that the approximate average price of the coal was a shade less. To be precise, the total value of the output of coal in 1911 was £110,783,682, or £2,406,115 more than that of the previous year; while the average price at the colliery was 8s. 1·79d. per ton, against 8s. 2·36d. in 1910.

Exports and Home Consumption.

The quantity of this coal exported, exclusive of coke and manufactured fuel, and of coal shipped for the use of steamers engaged in foreign trade, was 64½ million tons, or 2 million tons more than for the preceding year. When to this there is added the 3¼ million tons exported in the form of coke and manufactured fuel, and the 19¼ million tons shipped for the use of British and foreign steamers engaged in foreign trade, it is found that the total quantity of coal which left the country in 1911 was about 87 million tons, as against 84½ million tons in 1910. This left nearly 185 million tons for home consumption, or 4·079 tons per head of the population. During the past 39 years (1873 to 1911), it is gathered from the Blue-Book, the total value of the minerals raised in the United Kingdom amounted to the enormous sum of £3,227,783,582; and of this, coal accounts for £2,687,137,593, or 83 per cent. Of the 7,392,732,000 tons of coal raised in the period named, nearly 24 per cent. has been shipped abroad as exports in the form of coal, coke, and manufactured fuel, and as coal used for steamers engaged in foreign trade.

PERSONAL.

Reference is made in our editorial columns to the honour of knighthood conferred by the King upon Mr. CORBET WOODALL, D.Sc., M.Inst.C.E., the Governor of the Gaslight and Coke Company. Some of our readers may remember that the new knight has family associations with the Potteries, and, in addition to the several gas undertakings with which he is connected, he is Chairman of Messrs. James Macintyre and Co., of the Washington Works, Cobridge, Burslem; and by all who have come in contact with him in the locality he is greatly esteemed. He used to attend the annual party held at the works by the employees, by whom he is held in the highest regard. News of the honour was received at the works with much jubilation last Wednesday morning; and a meeting of the 400 employees was called to express the gratification felt by all at the event. The Managing Director (Mr. Henry Walkin) presided, and remarked that the New Year, so far as the Washington Works were concerned, had opened very happily. The first news that met his eye that morning was that the King had been pleased to confer a knighthood on their Chairman. Personally, he felt that nobody was more worthy of the honour bestowed, for he was not only one of the greatest authorities in the world on gas engineering, but he was also one of the pioneers in profit-sharing schemes, having organized one which embraced no fewer than 11,000 people. They were all gratified that a man of such character and ability should occupy the chairmanship of their own works. Mr. J. Gibson, who has been in the employ of the firm for fifty years, moved that congratulations should be sent to the new knight. This was seconded by Mr. J. H. Cresswell, another employee of thirty years' standing, and heartily carried. In celebration of the honour, the workpeople were given a holiday for the remainder of the day, at the firm's expense.

From among 67 applicants, Mr. FREDERICK VERNON BARNES has been selected by the Todmorden Corporation Gas Committee for the position of Engineer and Manager. The appointment is, of course, subject to confirmation by the Council. Mr. Barnes has for fourteen years been connected with the Nottingham Corporation Gas Department; holding now the position of Superintendent of the Eastcroft works—one of the oldest carbonizing stations in the southern portions of the city.

The current number of the "Bulletin" of the British Commercial Gas Association contains the essential items in the report presented by the Executive Committee to the General Committee on the 3rd ult. One of these bears upon the number of Vice-Presidents; and it is stated that, the restrictive provision in this respect contained in the rules having been deleted, the following were recommended for election: Sir JOSEPH BELLAMY, Chairman of the Plymouth and Stonehouse Gas Company; Mr. H. WADE DEACON, Chairman of the Liverpool United Gaslight Company; Colonel G. GASCOYNE, Chairman of the Derby Gas Company; and Mr. F. W. GOODENOUGH, Chairman of the Executive Committee.

With the close of 1912, Mr. JOHN CHEW completed fifty years' management of the Blackpool gas undertaking; and he has been the recipient of hearty congratulations on the event from members of the Gas Committee and a wide circle of friends. On several occasions in recent times, reference has been made to Mr. Chew's long connection with the undertaking and the developments which have taken place under his management. It is of interest, however, to recall that when Mr. Chew took up duty at Blackpool, in 1861, there were only 650 consumers, while the total to-day is 15,800; the price of gas was 5s. 10d. per 1000 cubic feet, compared with 2s. 2d. for lighting and 1s. 10d. for power to-day; and the total profit at the Princess Street works has been £308,000, of which £255,000 has directly gone towards the relief of the rates.

OBITUARY.

WILLIAM COULSON PARKINSON.

THE preparation of the first number of the "JOURNAL" for the New Year has brought with it a sad duty—the recording of the death of Mr. W. C. Parkinson, a senior member of a firm whose name is known and respected throughout the gas industry of the whole world. Though the deceased gentleman did not himself mix with gas people a great deal, he took a keen interest in the important business with which he was connected, and in his time did his fair share of public work on the London County Council, while he was also connected with various institutions doing good work. His loss will be widely deplored—and, among others, by those who worked for him, and understood his upright disposition, and by the members of the London and Southern District Junior Gas Association, who (with the writer) remember the kindness of his reception when they visited the meter-works in Cottage Lane, City Road, a few years ago. The death of Mr. Parkinson took place last Sunday week, at his house at Hornsey, after only a fortnight's illness, which he at first regarded as a chill, but which was in reality a heart attack. Until this illness, he continued to come down to the works fairly regularly, though he had reached the age of 71 years; and in addition to thus attending to the affairs of the firm, he was a Director of the Dartford Gas Company, the Colonial Gas Association, the Annfield Plain and District Gas Company, and the Counties Gas Company.

The meter-making business—the oldest in the country—with which the name of his family became associated was established in 1816 by Messrs. S. & J. Crosley; so that in three years' time its centenary will be reached. The Crosleys both died in 1847, and left the entire business to Mr. Parkinson's father, who had been for some years engaged with them. His father died when Mr. W. C. Parkinson was still quite young; but in due course the son succeeded to the business, which steadily grew—more especially after the introduction of the slot meter. As a matter of fact, when Mr. Parkinson first took charge of affairs in 1862, the number of men engaged was about 200; whereas now the amalgamated firm employ some 1500 hands, and have branches in both Australia and New Zealand. In 1890, the firm of W. Parkinson and Co. absorbed the meter and lamp business in Birmingham of John Bent and Son; and this was followed, in 1900, by a further amalgamation—this time with the firm of W. & B. Cowan, Limited. The present Company then adopted the title of Parkinson and W. & B. Cowan, Limited; and Mr. Parkinson remained a Managing-Director until his death. In the business at Cottage Lane at the present time there is Mr. F. R. Smith, the brother-in-law of the deceased, who has been with the firm for about forty years, and Mr. W. W. Parkinson, his eldest son.

The funeral, which took place last Thursday, at Highgate Cemetery, was largely attended, and afforded eloquent testimony to the great respect in which Mr. Parkinson was held, and to the sympathy felt with the widow and large family who are left to mourn their loss.

The death occurred suddenly last Sunday, at Grove House, Fulham, of Mr. JOHN WILLIAM RANDELL, Engineer of the Fulham station of the Gaslight and Coke Company—a position he had held for some time. He was in his sixty-third year of age, and thirty-seventh year of service with the Company. The funeral is fixed for half-past two o'clock to-morrow, at Putney Vale Cemetery.

The death occurred on the 29th ult. of Mr. JOSEPH GURNEY FOX, the Senior Auditor of the Imperial Continental Gas Asso-

ciation. Mr. Fox was elected Auditor at the general meeting in May, 1903, and had thus occupied this position for nearly ten years.

The death has just occurred in Paris, at the age of eighty, of M. Louis Paul Cailletet, the President of the Aéro Club of France. In his younger days, the deceased distinguished himself by his researches and discoveries in connection with the dissociation of gas and the liquefaction of air. He was elected a member of the Academy of Sciences in 1884.

The recent death, at Worcester, is announced of Alderman Henry Long, late Head Manager of Stringer Bros., Albion, West Bromwich, who retired to Worcester twenty-five years ago. He was elected Chamberlain in 1906, proceeded to the higher offices of Sheriff and Mayor the following two years, and was made an Alderman in 1909. Deceased was sixty-five years of age.

GAS STOCK IN THE PAST YEAR.

GAINS AND LOSSES.

According to usual custom, we publish a table showing the closing prices of gas stocks and shares at the end of 1911 and the end of 1912, with the respective gains and losses in value. The fact that shrinkages in quotations are largely in excess of advances need not cause shareholders any anxiety regarding the condition and prospects of the gas industry. The year has been a sore one, with wars abroad and domestic troubles at home, which could not but exercise a depressing influence upon securities in general. Another factor which must not be lost sight of is that, notwithstanding the turmoil, trade has been very brisk, and has absorbed an amount of capital which would otherwise have sought investment in the Stock Exchange.

[The weekly Money Article and Stock and Share List will be found on p. 57.]

GAS COMPANIES.	Prices on Dec. 31, 1911.	Prices on Dec. 31, 1912.	Gain or Loss.
Alliance and Dublin, Ordinary	79—82	73—78	−5
Do. 4 per cent. Deb.	93—95	83—86	−9½
Bombay, Limited	6—6¼	6¼—7	+½
Bournemouth, 10 per cent.	29—30	29—30	..
Do. B 7 per cent.	16¾—16⅞	15⅞—16¼	−½
Do. Preference 6 per cent.	14⅞—14⅞	14—14⅛	−¾
Brentford, Consolidated	256—261	257—262	+1
Do. New	198—203	198—203	..
Do. 5 per cent. Preference	120—122	116—118	−4
Do. 4 per cent. Debenture Stock	97—99	94—96	−3
Brighton and Hove, Original	217—222	210—215	−7
Do. A Ordinary Stock	156—159	152—155	−4
British	44½—45⅝	44⅛—45¼	..
Do. 4 per cent. Debenture Stock	92—94	89—91	−3
Buenos Ayres, 4 per cent. Debenture	94—96	92—94	−2
Cape Town and District, Limited	2—3	2—3	..
Do. 4½ per cent. Preference	4⅛—5⅛	3⅛—4⅛	−1
Do. 4½ per cent. Deb. Stock	78—81	71—75	−6½
Chester 5 per cent. Ordinary	111—113	110—112	−1
Commercial, 4 per cent. Stock	110—112	106—108	−4
Do. 3½ per cent. do.	105—107	102—104	−3
Do. 3 per cent. Debenture Stock	75—77	71—73	−4
Continental Union, Limited	85—89	83—86	−2½
Do. 7 per cent. Preference	132—134	130—132	−2
Derby, Consolidated Stock	122—124	124—125	+1½
Do. Debenture Stock	104—105	103—105	−½
European, Limited	20—21	19—20	−1
Gaslight and Coke, 4 per cent. Ordinary	104⅜—105⅝	105—107	+¾
Do. 3½ per cent. maximum	84½—86½	82—85	−2
Do. 4 per cent. Con. Pref.	102—104	100—102	−2
Do. 3 per cent. Con. Deb.	79—81	75—77	−4
Hastings and St. Leonards, 3½ per cent.	94—96	91—93	−3
Do. 5 per cent.	..	..	.
Hongkong and China, Limited	17—17½	16—16½	−1
Ilford, A and C	154—157	154—157	..
Do. B	125—128	121—123	−4½
Do. 4 per cent. Debenture	92—94	89—91	−3
Imperial Continental	190½—192½	175—178	−15
Do. 3½ per cent. Deb. Red.	90—92	86—88	−4
Lea Bridge Ordinary, 5 per cent.	125—130	122—125	−4
Liverpool United A	219—221	223—225	+4
Do. B	163—165	161—163	−2
Do. Deb. Stock	100—102	98—100	−2
Maidstone, 3 per cent. Deb.	..	69—71	..
Malta and Mediterranean	4⅝—5	4⅜—4¾	−¼
Metropolitan of Melbourne, 4½ p.c. Deb.	100—102	99—101	−1
Monte Video, Limited	12—12½	12—12½	..
Newcastle and Gateshead, Consolidated	101½—102	99½—100½	−1¾
Do. 3½ p.c. Deb. Stk.	85⅝—87½	85⅛—86⅛	−1⅜
North Middlesex, 7 per cent.	14⅝—15½	13⅜—14⅜	−1
Oriental, Limited	134—136	125—130	−7½
Ottoman, Limited	6⅜—7½	8½—8⅝	+1½
Portsea Island B.	133—138	127—130	−7
Do. C	130—135	124—127	−7
Primitiva, Ordinary	7⅜—7⅝	6½—6⅝	−1
Do. 5 per cent. Preference	5⅛—5⅝	5—5¼	−⅜
Do. 4 per cent. Deb. Stock	97—99	96—98	−1
River Plate, 4 per cent. Deb.	94—96	92—94	−2
San Paulo, Limited	10⅜—11	13—14	+2¾
Do. 6 per cent. Preference	11⅜—12	11⅜—12	..
Do. 5 per cent. Deb. Stock	50—51	49—51	−⅛
Sheffield, A	239—241	231—233	−8
Do. B	239—241	230—232	−9
Do. C	239—241	229—231	−10
South African	8—9	9⅛—10½	+1⅜
South Metropolitan, 4 per cent. Ordinary	116—118	116—118	.
Do. 3 per cent. Deb. Stk.	79—81	76—79	−2½
South Shields Consolidated Stock	157—159	163—165	+6
South Suburban, Ordinary 5 per cent. Stk.	121—123	119—121	−2
Do. 5 per cent. Preference Stk.	117—120	117—119	−⅛
Do. 5 per cent. Debenture Stk.	121—123	118—120	−1*
Southampton, Ordinary	107—109	102—105	−4½
Tottenham and Edmonton, A 5 per cent.	145—148	142—145	−3
Do. B 3½ per cent.	115—117	115—117	..
Do. 4 p.c. Deb. Stk.	94—96	92—94	−2
Tuscan, Limited	8⅜—9	8—8½	−½
Do. 5 per cent. Deb. Red.	99—101	97—99	−2
Tynemouth, 5 per cent. maximum	114—116	115—115½	+¼
Wandsworth and Putney, B 3½ per cent.	142—145	139—142	−3
Do. 3 p.c. Deb. Stk.	71½—73½	68—70	−3½

* After correction for change in date *ex div.*

ELECTRICITY SUPPLY MEMORANDA.

A Review of the Past Year.

We are inclined to think that the year that closed a week ago saw an improvement in the relations of the electrical industry with the gas industry—at all events, the latter part appeared to indicate it so far as the more public doings of our competitors are concerned, though within many supply districts much the same misrepresentation of gas privately continues, and much the same influences are brought to bear against gas and in favour of electricity—more especially where there is municipal control of the latter. The electrical industry has an inglorious record of calumny in the commercial campaign; but it has been made to see that the gas industry is not prepared to take that slander—and slander of the coarsest character—"lying down." It has been shown that the gas industry can make a stout defence, as well as be aggressive on occasion, if forced to it. The lesson has been taken to heart with profit in some quarters. We know for a truth, too, that there are influential electrical men who are absolutely ashamed of certain of the dishonest and slanderous tactics adopted for commercial advancement in the electricity industry; and there are others who, while not protesting against the tactics of some of their fellows, would not soil their tongues or their cause by following their example. At the beginning of the year, the "Journal" was concluding its controversy with the Engineering Correspondent of the "Daily Telegraph;" and we will not boast of the matter beyond saying that our fellow controversialist acknowledged his errors, and the insecure foundation upon which he had attacked the interests of the gas industry, through its commodity and uses. The scene of the labours of the Engineering Correspondent has since shifted; and his successor seems (as his predecessor was during the last few months of his reign in the position) desirous of holding the scales fairly between the two industries.

There have been, however, spasmodic outbreaks of abuse and mendacity in other quarters that have been dealt with in the "Memoranda" as they have arisen. We recognize a difference between abuse and a fair use, in gaining or retaining consumers, of the disadvantages or weaknesses of a competitor. Other considerations besides cost come into play, and that frequently, in the work of persuasion. No canvasser can speak so well of the qualities of his own commodity as the man who knows the character of the corresponding qualities of his competitor. It is true the arguments of our competitors on the matters we have in mind have become trite and commonplace. But occasionally, in the course of the year, we have seen them used with increased virulence, and to such a degree that those possessing chemical and physical knowledge have at times wondered whether there is not a touch of lunacy in the authors and those who publish their wild vapourings. Among the literature we have seen, that which the Electricity Publicity Committee—the individual members of which Committee would assuredly resent very much being accused of any want of intelligence—have issued, contains statements which we assert are of an untrue order, and which we here challenge them to justify. Among other things they published extracts from certain manuals of hygiene, two or three of the authors of which have confessed [see "Competition Points for Gas Salesmen," p. 84] that their statements do not apply to present conditions, nor, we venture to add, to former conditions, as would have been found by proper and competent investigation. One electrical engineer has lately been breathing forth many aphorisms bearing upon the cultivation of good conduct among the workers in the electrical industry. One of them referred to the "square deal," and another was "Do not abuse your competitor." Straightway, the disseminator of rules for virtuous behaviour accompanied his "Sales Manager" in the authorship of an article on electric cooking, in which they made clear their views that the "fumes" from methods of cooking other than the electrical one were extremely unhealthy, depressing, and enervating, and that the health of cook or mistress is daily being undermined by these "extremely unhealthy conditions." So we go on, getting side lights here and side lights there as to the difficulties of electrical competitors in making satisfactory headway on the merits alone of their commodity.

There has been more talk in the course of the year on the subject of domestic electrification. Some electrical folk are optimists, and think that the domestic electrical era is at hand, and that on every side light, heat, and power electrically generated will soon prevail. But they are not all optimists in the electrical industry; and they are not all so foolish as not to see that there are sides on which their commodity strikes narrower limits than the competitor. The Institution of Electrical Engineers (who have extended the orbit of their activity, and have appointed an Industrial Committee and a Research Committee) have had informal discussions during the year to endeavour to find the causes for the slow movement in the development of the domestic load, and to take counsel as to how to energize it. The members rediscovered causes, and reiterated plans. Here and there in the discussion, there came into view the recognition of some electrical engineers that there are some things that gas can do better and more economically than electricity. That is something for an electrician to admit. Even the ex-President of the Institution (Mr. S. Z. de Ferranti) has recognized that for such purposes as heating, the low cost of the B.Th.U. of gaseous fuel is an adamant

obstacle for electrical engineers; and the new President (Mr. W. Duddell, F.R.S.) also agrees that there are material impediments in the path of an equivalent efficiency in certain respects. Views are also diametrically opposed as to the real extent that possession or otherwise of wiring and fittings powers has upon really profitable progress in the electrical industry. In the retrospect (published last week) devoted to the affairs of the gas industry, there was information as to the fight made by the Sheffield Corporation and the National Electrical Construction Company over this matter, as well as the results. The parliamentary session also witnessed an attempt to push forward the Bill of the Municipal Electrical Association, the framers of which have opened their mouths to such an extent that is certain, when our legislators get into serious contact with the Bill, to cause them to exercise freely their right of rejection or revision.

Some electrical engineers, narrow visioned as they are, appear to think that tariffs have more to do with the question of trading progress than anything else. By the degree to which prices for power, heating, and cooking units have been reduced below those of the ordinary lighting units, there has been abundant indication of the gravity of the difficulties the electrical industry have to face in the commercial competition in these directions. Mr. A. H. Seabrook, of Marylebone, is a devotee of Expediency; and he has adopted almost every form of tariff on which he can lay hands, so that the Marylebone consumer may make choice of the one he prefers. However, generally speaking, there is in the electrical industry a fearful tangle of opinion on this tariff question, as has been evidenced by the Institution discussions on the subject. Pity has been expressed for the poor lighting consumer, who has to bear the standing charges where low-priced units for power, heating, and cooking obtain, though others try to prove, in an easy intangible sort of way, that the lighting consumers are better off for this load, while the ordinary lighting consumers sit patiently waiting for the material evidence, which rarely comes. There are two or three towns that have got down to ½d. per unit for heating and cooking purposes; and others, under the system of a prepaid lump sum and a price per unit afterwards, are also charging ½d. per unit. The ten engineers who claim to be supplying electricity for some purpose at ½d. per unit (the lump sum is ignored) have banded themselves together as the "Point Fives" club. Standing alone 0·5d. per unit cannot be a paying sum for current for a heating and cooking load. But there is absolution in that ever-blessed word Expediency.

During the year there have been signs of the recognition by some electricity suppliers of the folly of going too far in this matter of the reduction of the price per unit for purposes other than lighting. The increase in the power load is in some cases bringing the average price received per unit down to a dangerous level. The conditions of demand make a vast difference as to the politic course to pursue in this matter of price. The administrators of some undertakings, with experience to back them, are retracing their steps. In West Ham the prices have been somewhat raised. The Chairman of the Charing Cross Company stated at the spring meeting of the shareholders that the average price that was being received per unit was rather low; and they were trying to raise it. The Company were also, he said, devoting their attention to the capture of large consumers; the inference being, that the small ones are not particularly worth the powder and shot expended on them. Since then, the Company have, under a new contract, raised the price to the Metropolitan Asylums Board from 3d. to 3½d. per unit for lighting, and from 1d. to 1½d. for power. In Southampton, where only ½d. per unit is charged for heating, the Electricity Committee and the Council have become dissatisfied with the business in the heating branch. They find that the rates of hire for radiators have not been high enough; they have raised them. They also find that, after radiators costing perhaps £2 and upwards have been fixed, the ardour of the users cools for electric "heating," and orders are received to remove the impostors. Consumers are now to agree to keep and pay for radiators on hire for twelve months certain. There are other people, too, who look in quite another direction on the low-priced unit with more concern than the symptoms warrant. The point has been raised that, if these units bring about a large rush of business for cooking and heating, the distributing mains will not be big enough, and that a large capital expenditure on plant for these low-priced units will not be warranted. The lump sum and the low price per unit tariff are intended to serve the double purpose of tempting the consumer, and to prevent the necessity for double wiring of houses. But the fact remains that a large proportion of wiring at present in houses is totally inadequate for a heating and cooking load. This is an awkward point, about which the consumer gets information when he is well within the net of the electrical canvasser. One other matter as to tariffs. The electricity industry is not getting on very well with the working class part of the population. Though now and again we get the visionary talking of electricity for everybody, the practical men of the industry with experience soon bring them to earth again, or rather those of them who are not past things temporal. Our attention was called in the course of the year to a place in Sussex where a trial had been made of supplying electric light to working-class dwellings at a fixed rate per week; but it was found necessary to put in prepayment meters. Revenue then went up; units down. At Barking, too, the department has found it necessary to raise the fixed charges for certain dwellings, or give tenants the option of using ordinary meters. At Ebbw Vale, where an experiment has been made at supplying light for 8d. per week, there has been dismal failure. The people leave the lights running all night, and give the electricity suppliers no end of trouble in collecting the money.

From the electrical industry much has emanated during the year as to the shortcomings and defects of electric lighting. There is the question of stagnant air. Stagnant air means atmospheric insanitation. It has been found in many electrically lighted places where people assemble. The Engineering Correspondent of the "Daily Telegraph" complained of the mephitic condition of the Patent Office Library. Complaints as to stagnant air in the electric-lighted Council Chamber at Brighton have necessitated alterations to the roof, and the application of more electric-fans. "Meteor," too, has continued his campaign against the stagnant air conditions of the theatre of the Institution of Electrical Engineers—the place of all places in the world that ought to be noted for atmospheric purity. In regard to lighting, there has not been much discussion as to comparative costs, since the controversy with the Engineering Correspondent of the morning contemporary already mentioned. There was a challenge issued to Mr. Cramb, of Croydon; but Mr. Cramb has been strangely silent over the matter. The year, however, has brought more and more evidence as to the hygienic inferiority of electric lighting compared with modern gas lighting. The quality of the latter is far better. The defects of the metallic filament lamp, and the injurious effects it has upon eyesight owing to high intrinsic brilliancy, have brought into existence the semi-direct, the semi-indirect, and the indirect systems of illumination; and the advocates of these various systems are the best possible persons for advertising the eye-injury arising from the use of exposed incandescent metallic filaments. The House of Commons during the year has had its lighting changed from gas to electricity without any experiment being made with modern systems of gas lighting. But the conversion was not effected before a very eminent oculist gave the comforting assurance that Holophane globes put round the lamps, and amber coloured sheets of glass in the roof above which the lamps are suspended, would neutralize the evil effects of the metallic filaments. The diffusion of the light of metallic filament lamps is also inferior to that of inverted gas-lamps. This has been proved in street tests where the candle power of the sources of light is equivalent.

The drawn-wire filament lamp has had proclaimed during the year its chief asserted virtue—namely, that of strength. Its consumption of energy is about the same as that of the squirted filament type; and as to strength, when the filaments of both kinds get crystalline, there is no difference at all in this respect between them. There are great and deep complaints still about the variable quality of metallic filament lamps. From the same batches of lamps, different efficiencies and different life-results are obtained; and the electricians grumble more or less audibly and forcibly about this. There has been further evidence that manufacturers' assertions as to the wattage per candle-power-hour is not generally in accord with what is actual. We are told there is on the horizon a lamp with an efficiency of 0·6 to 0·8 watt per candle-power-hour; but this comes from a quarter that has previously made extravagant announcements. We must therefore wait and see how far veracity is in the statement. Meantime, there does not appear to be any great hurry to put the lamp on the market. Perhaps the life is not what a good commercial lamp should possess. Threatenings are heard of further patent litigation as to metallic filament lamps, as the associated makers appear determined to bring into line makers operating outside, and paying no royalty—if they can.

Municipal possession of electricity supply still overshadows fair discussion of public lighting contracts. Where there is not the handicap of municipal possession, gas generally scores. It has been an interesting year in the matter of public lighting questions. There was the Hampstead affair, which gave the ratepayers the startling information that the conversion of the street lamps had cost some £10,000 more than the estimate, and yet had produced a system of lighting worse than existed before. The complaints of the ratepayers were admitted to have foundation by the decision to use higher power lamps. Marylebone has also found it essential to employ higher power lamps than were first installed. The lighting scheme under the joint gas and electric lighting tender in Holborn has been consummated; and the City joint scheme is being materialized as fast as possible. For public lighting contracts at Bournemouth, Doncaster, Guildford, and Newmarket, gas came out victorious. At Manchester there has been the curious trial in street lighting to which reference was made last week, in which gas-lamps of much lower candle power than the flame arc lamps gave the same illumination at the testing level, with more even distribution, and a better quality of light. Mr. Haydn Harrison has called attention to the local bright light, with shaded spaces between, given by flame arc lamps; and he stated last April that during the preceding twelve months he had been responsible for the conversion to metallic filament lamps of at least 1000 flame arc lamps. High-pressure gas-lamps have also proved an awful thorn in the side of the flame arc lamp. They are now assisting in removing flame arcs from shop frontages; and electricity suppliers are at their wits' end to know how to dam the tide of popularity in their favour. At many places there has been a special reduction in the price of electricity for shop-lighting purposes.

Heating by electricity, for obvious reasons, has not made much headway. It is impossible to ascertain from the accounts of electricity undertakings, the actual progress (if any) that is effected

year after year. The energy used for power and heating is all lumped together in the published accounts. But gas men know that they are constantly putting in the modern gas-fire where the electric radiator has been temporarily established; and the public are learning from those who have had experience of electric radiators that they are not effectual for their purpose just when they are most required. Now and again in the course of the year there has been the usual display of electrical ignorance regarding the escape of "poisonous" products from gas-fires; while, on the other hand, Dr. Leonard Hill and others who have made the question of heating and ventilation a matter of scientific study have pointed out the healthful advantages of a form of heating that induces a renewal of the atmosphere of rooms by causing the chimney to act as an efficient ventilator. "Dead" air is abominated by the modern hygienist; and "dead" air finds that the electric radiator is a friendly abettor. As we were told at the meeting of the British Commercial Gas Association, some 2500 doctors out of a possible 4000 in the area of the Gaslight and Coke Company are now using gas fires and heaters. Electricians are sometimes candid critics of their own appliances; and, more than once in the run of the year, there have been indications as to the special nursing that electric radiators require in order to enable them to properly effect their destined function. They should be used in different parts of a room, and not fixed near the fire place, where a draught may pass over them, and steal and carry up the chimney the modest amount of heat given off. The poor structural quality of some types of radiators through the necessity of producing something cheap, and the cost of lamp renewals, are matters that have been electrically regretted during the year. The Southampton experience already referred to, when dealing with prices for current, is illustrative of what consumers, after experience, think of the electric radiator. The foolish faces of the pair of puppies on the front of the Electric Supply Publicity Committee's radiator leaflet properly represents the countenance of an electric radiator user when he finds, on a cold day, that he has been "sold" by a glib-tongued canvasser.

Water-heating is another branch of business over which there has been a further expenditure of effort to cultivate. New electrical appliances for the purpose appear; to trace their use by the public is like looking for a needle in a haystack. The absurdity of the electricity industry trying to supplant efficiency, sufficiency, and convenience, by inefficiency, insufficiency, and inconvenience has been felt by more than one station engineer. There are station engineers (one or two within our own knowledge) who have induced consumers used to a liberal supply of hot water rapidly produced to change over to electricity for the purpose; and these engineers have never regretted anything more than the part they had in the matter. There are electricians who naturally prefer gas for the purpose, and who are wise enough not to bring electricity into disrepute by false pretences.

But the biggest piece of humbug that the electricity industry has had a hand in has been the campaign to convert the public to electric cooking. We have had some very pleasant times in connection with this matter during the year. It has been conceded by our electrical friends (they cannot help conceding it) that the first cost of electric cooking appliances to do the same amount of work as a gas-oven is greater than that of the latter, that the cost of installation is heavier, that the cost of renewals is greater, and that the life of such appliances cannot possibly be as long. They do not talk of it, but they know that it is true, that the cost of all boiling operations is greater than is the case with gas; they know, too, that the cost of roasting and baking is more, and that the time occupied in the processes is greater. They are also aware that the range of temperatures obtainable with gas is greater, and can be governed to any point; while with the electric oven and other heaters, the temperatures are fixed by the switches. They know, too, that the electric oven is more liable to failure than the gas-oven; and they are likewise fully acquainted with the fact (as we shall show presently), that electricity supply is liable to extensive and to sudden failure. Therefore they fall back on the relative shrinkage of meat—claiming that meat baked in the electric-oven shrinks less than meat baked in the gas-oven, and that the difference in the amount of water evaporated should be weighed up and priced out at the retail cost of the meat. This to onlookers is one of the most humorous things that has ever been seriously put forward in the commercial campaign between electricity and gas. We have tried to get explanation from electrical sources as to why it is thought that meat, with the exact temperatures to which it can be subjected in the gas-oven, and by methods of baking available to every user of a gas-oven, cannot be baked at a temperature and to a degree that will show no more evaporation of the water content of the meat than in the case of the electric-oven. No electrical advocate will commit himself to any definite and rational explanation. No one will come out into the open, and meet a gas-cooking expert and prove by demonstration the impossibility of an equality on this point. Challenges have been issued; and evasion and refusal to have a competitive demonstration have been the result on every occasion. Instead, dear Mrs. Beeton's book is referred to as the authority on the loss in weight of gas-cooked joints. Every authority on the cooking of meat has her or his own views as to the degree to which meat should be baked—no matter the method. Percentages of "meat" loss in the gas-oven are referred to, ranging from about 25 per cent. up to a figure leaving little but bone in a sirloin of beef or a leg of mutton. With all the experience of cooking by gas through recent decades, it is impossible to imagine men of intelligence putting their names to such insensate rubbish, and permitting it to be circulated. The promulgation of such disgraceful falsehoods is not consistent with a high standard of morality in commercial life. It is almost as bad as the poisonous products' slander, over which Counsel's opinion was taken, and a strict watch was kept over the doings of certain electrical concerns, the managements of which made a hurried change from their slanderous policy. During the year, we published some comparative tests made at Brighton. Regarding the reliability of electric cooking appliances, Mr. Seabrook, of Marylebone, protested against the defective apparatus that was being placed on the market; and his Sales Manager (Mr. Holmes) told how in Marylebone they paid high prices for their electric-ovens. Nevertheless, they advocated a weekly inspection of installations by a competent man. A few municipalities have decided to spend a couple of hundred pounds or so on an experiment in the hiring out of electric-cookers.

Turning to other matters, the accounts of electricity concerns published during the year show that there was progress of business in some places, while in others there was a set-back for various local reasons. Consumption increases were for the most part due to power demand. Financially, there were again the usual varied experiences—some undertakings showing deficits, while others in the best areas for business exhibited improved returns. Various undertakings do not seem able to rise to brighter conditions; and some local authorities have been considering the question of parting with their undertakings to companies. Acton has done so; Dudley is proposing to do so; Barking was recently prepared to consider an offer; and Cromer was negotiating to the same end. The Woolwich white elephant has come in for a lot of criticism. The Barking undertaking's finances have received severe criticism at the hands of the Local Government Board; and a remarkable state of affairs was disclosed at an inquiry at Bray. At some inquiries local authorities have been severely reprimanded for applying for loans for short-lived plant—such as motors, radiators, and meters—while they are transferring profits to the relief of the rates. So it comes about that established gas undertakings, that are the possessors of conditions that must contribute to economy, are now looked upon as being pre-eminently in a position, in small and medium sized towns, for affording a supply of current to those who desire it. The evil in curtailing fair competition between gas and electric lighting for public institutions has been again demonstrated during the past year by the actions of local authorities with electricity undertakings under their control.

There has been a long roll of deaths during the year through electricity—several in connection with private installations, with current at 200 to 230 volts; and, in most of these cases, the medical testimony was that no organic disease could be discovered that had contributed to the lamentable result. News came from America as to death having been occasioned with pressures as low as 110 volts.; and Professor Jellinek, of Vienna, testified to death having occurred within his personal knowledge with current as low as 65 volts. Mr. G. Scott Ram, who is the Chief Electrical Inspector of Factories, reported a greater number of electrical accidents at generating stations and in industrial works; and he had a turn at the dangers of flexible electric wires and laundry irons. There have been several explosions during the year occasioned by the generation of gas from the insulation of electric cables. The Electricity Committee of the Nottingham Corporation had to confess that the wrecking of the Albert Hotel was due to this cause; and had to meet claims for compensation amounting to £5000, and provide an annuity of £52 for the assistant manageress of the hotel. The Committee have, as a consequence of this experience, undertaken an elaborate system of ventilation throughout the distribution system.

Failures of electric supply have been prolific during the year; and the incapacity of electricity for generating fires has been demonstrated beyond contradiction to be nothing but a figment of the electrical mind. The switchboard fires that did so much damage at Islington, Ilford, Salford, and elsewhere showed that electricity does not attach much importance to the scene of its destructive operations. A list of the failures of the year that have come to our knowledge is as follows: Jan. 11, Southport; Jan. 18 and 19, Woking; Feb. 4, Congregational Church, Ilkeston; Feb. 6, Hull Law Courts; Feb. 13, Royal Albert Institute, Windsor; Feb. 16 (partial), Kensington; Feb. 26, Repertory Theatre, Liverpool; Feb. 27, Wimbledon; March 5, Camberwell Palace Music Hall; April 2, Cowdenbeath; April 13, Liverpool Post Office; during the Easter Vestry, St. Saviour's, Guildford; April 14, Liverpool; April 15 (total failure), Liverpool; June 23, Imperial Yacht Club, Kiel; July 11, Southport; July 15, London Underground Railways; Aug. 13, Leigh; Aug. 27-9 (due to floods), Norwich; Aug. 25, Paris; Aug. 31, Newquay; Sept. 6, Eccles; Sept. 9 (total failure), Islington; Sept. 9, Coventry; Sept. 19, East Ward, Scarborough; Sept. 24, Ilford; Sept. 27, part of Swansea; Sept. 29, two failures at Dublin; the "Electrician" referred to small failures at Derby and Glasgow; Oct. 11, Cardiff; Oct. 11, Highbury; Oct. 12, St. Leonards; Oct. 15, Merthyr and Dowlais; Oct. 17, Berlin; Nov. 2, Worthing; Nov. 13, Whitehall Club; Nov. 15, Heywood; Nov. 19, Paris; Nov. 21, Bolton; Nov. 21, Lynton and Lynmouth; Dec. 7, Paris; Dec. 15, Belfast; Dec. 17, Sheffield; Dec. 18, Dundalk; Dec. 19, Salford; Dec. 30, Great Northern, Piccadilly, and Brompton Tube and District Railways; also in December, at Rhyl. There were failures through accidents to Diesel oil-engines at

Bray, on July 10; at Maidenhead, on Sept. 4; and at Guernsey, on Nov. 4.

Several fires have occurred during the year that are known, or reported, to have been due to electrical causes. On Jan. 4, there was an electrically generated fire at 126, Jermyn Street, Haymarket; Jan. 11, at the Misses Wayland's millinery shop at Winchester; Jan. 26, at Messrs. Cash and Co.'s boot shop, at Ilkeston; in February, the electric light station at Heinitz (Germany) was destroyed by fire; in February, at Christ Church (near the organ), Salford; March 6, electric power station, Old Lodge Tinplate Works, Llanelly; March 17, at St. Mark's Church, Newport, Mon., some of the congregation were thrown into commotion by the fusing of an electric wire, and the appearance of smoke near the roof; April 26, an electric spark and shellac combined to bring about the destruction of valuable machinery and materials at the factory of the Columbia Phonograph Company at Wandsworth; in April, the shop of Mr. Brentman, of Portsea, was destroyed, and four lives sacrificed. Only electric light was used in the shop (there was no gas on the premises); but in the middle of the night, the shop caught fire. The cause was not definitely determined, but the evidence pointed to the electric installation having been the cause. A fire occurred on June 9, at the Picture Palace, High Wycombe, through the fusing of an electric wire; on Aug. 14, there was a panic at the Morecambe Tower, owing to an electric wire fusing, and setting fire to curtains and a number of papers; Aug. 24, at the General Post Office; Aug. 27, at the steel foundry of the Howaldt works, at Kiel; Sept. 18, Piccadilly, Manchester, through the fusing of an electric cable under the pavement; Sept. 9, Islington generating station; Sept. 24, Ilford generating station; Dec. 3, small one at the British Museum; Dec. 6, Epping Town Hall; Dec. 7, St. Denis generating station, Paris; Dec. 7, on premises in Newgate Street; and Dec. 19, Salford generator station. The year ended with another drapery store fire. This time it was Messrs. Harvey, Nichols, and Co.'s establishment at Knightsbridge; and it occurred early on Tuesday morning, when some 200 girls were asleep on the premises. Fortunately all escaped. The outbreak was due to the fusing of electric cables in the basement. Dr. Waldo, the City Coroner, in a lecture on Nov. 19 before the Insurance Institute, stated that of the fires in the City supposed to have had electrical origin, there had been an average of thirteen during the past few years; while in 1910, there were nineteen.

GAS AFFAIRS IN SCOTLAND.

A Review of the Past Year.

THERE is no doubt that the historian of the gas profession will record 1912 as the year of the great coal strike. As in other parts of the kingdom, the principal event in Scotland of the year just concluded has been the strike in the coal trade. While this strike paralyzed most businesses, in none was it more felt than in the gas-works about the country. Coal is the foundation of the gas trade, which cannot live without its elementary requirements. For many weeks the country had to live on the sweeping up of the various collieries and on the stocks which most gas companies had laid up; and, while in one or two cases the supply was restricted and consumers were asked to be as sparing in the use of gas as possible, in nearly all instances the corporations and companies were able to give their customers a full and adequate service throughout the whole period of the stoppage of the coal supply. In many places the strike was not the trouble that might have been anticipated, but was a disguised blessing, in that it showed the consumers the value of having gas for heating and cooking, and that they could rely on the forethought of those answerable for its manufacture in having sufficient stocks to ensure a continuance of the supply.

The value of coke as a fuel was also demonstrated. While in a few places the price was raised, in response to the demand, in many others advantage was taken of the opportunity of adding to the friendly feeling existing between supplier and consumer by providing fuel at a low price; and this arrangement was much appreciated. All stocks of coke were used up before the strike ended; and there is no doubt that, had it lasted much longer, desperate remedies would have had to be resorted to to continue the manufacture of gas, as in many works the quantity of coal left was very small.

The question of storage has occupied the attention of many gas managers. The old recognized rule of providing six weeks' supply as the quantity to be held in reserve has been considered by many as insufficient, in view of the recent experience. Possibly this provision under cover is ample, with a further quantity stored outside if there is any likelihood of trouble or stoppage. Interest on the cost of building a store must be set off against the loss in both quantity and quality of the gas to be made from coal stored in the open, which, by weathering, may deteriorate considerably—in fact, in tropical climates it may be depreciated in value as much as 40 per cent. In these northern countries, the loss would not amount to nearly so much, and for the comparatively short period the coal would be exposed the loss would be inconsiderable, compared to the interest on the value of the building required to cover the coal.

The managers of those works where carburetted water-gas plants have been installed have been much freer from anxiety than others, as they could use up the coke made from their stock of coal, and so augment the ordinary coal gas supply. On the other hand, they could not enjoy the advantage of the higher market for their coke.

The Edinburgh and Leith Gas Commissioners early in the year called for reports from their Consulting Engineer (Mr. W. R. Herring), from the Engineer and Manager (Mr. Masterton), and from Mr. Canning Williams (the new Treasurer), upon the cause of the decrease in the consumption of gas, and the best way to extend their supply. As the outcome, they decided on a forward policy with the object of increasing the day load, and agreed to supply gas-cookers free of charge, with free fitting. This is also done in Glasgow, Dundee, Paisley, Aberdeen, Perth, and Kilmarnock. Gas-fires and other heating appliances are to be hired out and also fitted free by the Edinburgh Commissioners. They also have made an arrangement to supply gas cheaper to traders when they consume above a given quantity. New forms of demand notes and receipts have been issued; and the Commissioners have come to an agreement with the ironmongers and gas-fitters as to rates for installing gas stoves and fires. It has been suggested that the old gas-works in New Street, Edinburgh, should be used as a recreation ground. It has been arranged that the plumbing class at the Heriot-Watt Technical College, Edinburgh, should be divided into two—one for plumbers only and one for gas-fitters. This was rendered necessary, owing to the objections of the plumbers to the course of training taken by the gas-fitters' apprentices. An appeal by the Commissioners against the Assessors' valuation failed and the valuation was confirmed.

Among the new plant and extensions falls to be noted an installation of new electrical mechanical stoking plant at Perth. The trouble over the state of the retort-bench here has decided the Council to call in Mr. Gillespie to advise them on the subject. Dunfermline has fallen into line with many other places by adopting the vertical retort system, as there have been erected four of these at a cost of some £1200. Numerous extensions of plant and supply mains have taken place—among others at Inverkeithing, where the works have been further enlarged; and at Kirkcaldy, where the mains have been carried to light the village of Thornton—a large railway centre. Kirkconnel has been lighted by gas this last year for the first time.

At Falkirk, an explosion occurred in a condenser by which Mr. W. Wilson, the Manager, narrowly escaped injury; while the damage is estimated at £700.

High-pressure distribution and lighting are extending rapidly, notably at Dunfermline (where the main to Culross cost £600 less than was estimated), Falkirk, Airdrie, Greenock, Kirkintilloch, Glasgow, Edinburgh, and Logie Works, Dundee; while at Tayport the works of Messrs. Scott and Fife are being lighted by high-pressure gas. The Melrose Gas Company are supplying gas in bulk to St. Boswells. The supply to Thornton from Kirkcaldy, to Dunnipace from Denny, and Aberlady to Gullane, is all being carried out on high-pressure systems. Rothesay and Dunoon are also boosting the gas to out-districts; while Aberdeen is experimenting in this system.

Four companies have been registered as joint-stock concerns—namely, the Carfin, Newarthill, Cleland, and District Gas Company, the Thurso and North of Scotland Gas Corporation, the Banff Gas Company, and the Stonehaven Gas Company.

Motherwell and Brechin have adopted the Burgh Gas Supply Act. The Doune Gas Company have decided to sell their works to the Town Council, and a *plebescite* of the people in the burgh has been taken. The Bill of the Arbroath Corporation for a Gas Order confirmation and the Glasgow Corporation Gas Bill have both been passed, as has also the Extension Bill of the latter Corporation; but the Falkirk Burgh Extension Order was refused in August.

Gas exhibitions on a large scale have been held in Glasgow and Edinburgh—the former under the title of a Smoke Abatement Exhibition, when 93,000 people visited it; while 65,000 patronized the Edinburgh Exhibition. These have stimulated the gas-stove trade to a great extent, and the gas suppliers, not only in these cities but all around in their neighbourhood, have benefited by the prominence given to the advantages of gas for cooking and heating. The outdoor departments in both cities have been working overtime to try to cope with the increased work brought about through the applications for the supply and fitting up of the necessary apparatus. Smaller gas exhibitions were held at Coatbridge, Buckie, and Dumbarton. At the latter place, 700 applications for domestic appliances were received. While the great extension of gas cooking and heating in Edinburgh and Glasgow will probably be credited to the exhibitions, there is no doubt at all that the high price of coal during the strike made the public alive to the advantages of cooking their food and heating their houses by gas.

The North British Association's meeting at Aberdeen was very well attended. In his presidential address, Mr. Samuel Milne, of

Aberdeen, recommended a "cleaning-up day" at gas-works, which day of examination and cleaning "enables the discovery of potential troubles, and permits the remedy to be applied before the trouble actually discloses the existence of its cause." Papers read at the meeting included "Automatic Street Lamp Lighting and Extinguishing," by Mr. George Keillor; "Governors: Their Action and Application," by Mr. W. Carmichael Peebles; "Some Notes on Lighting Appliances," by Mr. S. B. Langlands; "A Year's Work with Vertical Retorts," by Mr. Wm. Blair; and also the William Young Memorial Lecture, by Dr. Colman, on "Carbonization in Ordinary and Vertical Retorts," which worthily continued the study of the actions in the retorts so ably carried out by the late Mr. Young. Mr. R. G. Shadbolt, the President of the Gas Institute, was made an honorary member. The Association also agreed to erect a Memorial tablet at Bello Mill, Lugar, Ayrshire, where William Murdoch, the inventor of gas lighting, was born.

The informal meeting of Scottish Gas Managers was under the presidency of Mr. James M'Leod, of Greenock, who referred in his address to the coal strike, vertical retorts, condensation, unaccounted-for gas, steam raising, the British Commercial Gas Association, and the very vexed question of the absorption into the North British Association, which was negatived; the *status quo* being retained. At the subsequent dinner, Mr. M'Lusky was presented with various gifts, amounting to about £74 in value, on resigning the convenership, to which Mr. J. W. Napier, of Alloa, was appointed.

The Waverley Association's meeting in Edinburgh was marked by a very able address by Mr. J. W. Napier, of Alloa, who spoke about the quantity of coal required in stock, and the value of other commodities obtained from it—namely, coke, tar, and ammonia—in view of their high commercial value in these days. He considered they should receive greater consideration than hitherto in assessing the value of the coal. The suggestion of a Commercial Section was also made, and has occupied the members of the Committee at a number of meetings. A proposal for a joint Commercial Section with the North British Association has not been favourably considered by the Waverley Committee.

The Junior Associations have both been busy during the year as regards papers submitted. In the Western District, these were as follows. First, a description of the Kirkintilloch Gas-Works boosting plant was read by Mr. James Bell, in which he described the De Laval turbine (3 H.P.) and fan, &c. Mr. R. B. Leckie, of Holytown, gave a paper on "Experiences of a Manager in Small Gas-Works." In the course of it, he referred to revivification of lime, which has caused considerable discussion among Scotch gas managers, and has led to the extension of the use of lime, or at least to the non-adoption of oxide of iron purification. [This paper gained the gold medal of the Association.] Papers were also read by Mr. Archibald Wylie, on "Gas Companies Maintaining Incandescent Burners;" by Mr. Niel Lindsay, on "Stocktaking and Costing;" and by Mr. Alex. Paterson, on "Naphthalene Troubles." A lecture was also given on March 13 by Mr. R. B. Taudevin, on "Gas-Furnace Work." This lecture was also given later in Edinburgh. Mr. George Donaldson discussed "Show-Room Practice." Mr. Alex. Wilson gave a most interesting paper on a number of points in "Manufacturing and Distribution." Mr. John Fraser spoke of some "Practical Observations," and Mr. James M'Leod laid bare some of his "Thoughts on Purification." Mr. MacLaren, in his Presidential Address, touched upon "Heating Matters;" while Mr. Walter Grafton was very interesting indeed in his remarks about "High-Pressure Gas Lighting."

The Eastern District were also to the fore. Mr. R. B. Chalmers contributed a paper on "Facts and Fancies in Small Works;" while Mr. Henry Rule described an unpleasant "Experience with a Gasholder." Mr. R. J. Philp gave some notes on "Vertical and Horizontal Retort Setting." Mr. Scott presented a paper entitled "Carbonization of Coal in Bulk;" and the Hon. Secretary one on "Coal Reserves." Mr. R. Scott gave some facts about "Damage Done to Mains through Subsidences;" and Mr. J. M'Millan referred to the "Ups and Downs of a Manager in a Small Gas-Works." Mr. A. Bishop gave his Inaugural Address, and Mr. Henry O'Connor lectured upon the "Bunsen Burner." The season closed in the Western District by the annual dinner in December, which was well attended. They also had a trip "doon the watter" during the summer months, which was so successful that there is every chance of its being repeated.

At the congress of the Textile Institute held at Hawick, a paper was read on "The Advantages of Installing Gas-Engines in Textile Mills" by Mr. T. R. Wollaston.

If the Junior Associations existed for the sole purpose of the visits they make to various works about the country, their existence would be justified. The advantage which such visits must be to the members, and not only to the junior member but to the most senior, is very evident when the varied nature of the processes which their members see carried out is considered, and also the chance to observe the actuality of what probably they have only before known of through book reading and study. The visits of both the Districts of the Scottish Junior Gas Association have been well attended, and in many cases have been taken advantage of by the seniors, who have accompanied the members and obtained much useful information, and at the same time helped their younger brethren by directing attention to points of importance which otherwise might have escaped notice. The gas-works visited were those at Kirkintilloch, Granton, Hamilton, Coatbridge, and Perth; the Otto-Hilgenstock Coke Oven Works at Auchengeich; and the collieries and gas-works of the Lothian Coal Company at Newtongrange.

There is one point that should be looked into by the two Secretaries of the Scottish Junior Gas Association when arranging their visit programmes, and that is to see these functions do not clash. They should meet together and try to fix up matters, when possible, so that seniors, and for that matter such juniors as could afford the more lengthy journey, could attend the visits of both districts. A further suggestion is that the reciprocation of hospitality should be arranged, so that members of either District would be welcomed by the other—of course, only after due notice in advance had been given to the respective Secretaries of such desire or intention.

The death roll this year contains the names of several gentlemen who will be much missed by their *confrères* in the gas profession. It includes Mr. Andrew Gillespie, the well-known consulting gas engineer; Mr. John Smith Gibb, the Treasurer of the Edinburgh and Leith Gas Commissioners; Mr. James Renfrew, of the Langbank Gas-Works; Mr. John Dennis, well known in connection with retort setting and a Director of several gas companies; Mr. James Lauder, of Bridge of Weir Gas-Works; and Mr. A. C. Fraser, a former Manager of the Stornoway Gas-Works and one of the founders of the British Association of Gas Managers. Among the provosts and councillors who have been interested in the gas questions and who have passed away are Sir Thomas Aitken, Ex-Provost of Leith; Ex-Provost Christopher Adamson, of Leven; Ex-Provost Baxter Gray, of Broughty Ferry; Bailie Dishart, of Kirkcaldy; Ex-Councillor J. M'Namell, of Wishaw; Mr. James Carswell, formerly Chairman of the Dalbeattie Gas Company.; and Mr. Wm. Ballantyne, a Director of the Coatbridge Gas Company. Mr. John Pirie, who was for nealy twenty-five years Scottish Correspondent for the "JOURNAL," died in February last.

Among the changes in officials which have occurred during the year we find that Mr. W. B. M'Lusky has removed from Perth to Halifax. This caused a general shuffling of the managerial cards, as Mr. David Vass went from Airdrie to Perth; being succeeded at the former place by Mr. Dugald Currie, from Belfast. Mr. William Ewing, formerly of Hamilton and Greenock, but recently at Lochgelly, has accepted an appointment at St. Louis, in North Brazil; his post at Lochgelly being filled by the appointment of two gentlemen, already in the employ of the Company—namely, Mr. Alex. Nisbet as Commercial Manager, and Mr. Wm. Heggie as Works Manager. A new post has been created in Glasgow—that of Commercial Superintendent; and from 96 applicants, Mr. Ralph Halkett, of the Leeds Gas Department, was appointed. Mr. J. D. Keillor moved from Ardrossan to Hawick; his place being taken by Mr. Alex. Dow. Mr. A. Walker, of Irvine, retired; and Mr. A. Ritchie, of Fraserburgh, received the vacant post. Mr. Alex. Mackay, who had been doing good work in extending the supply at Montrose, was appointed to Motherwell; his place being taken by Mr. James Mitchell, assistant at Dundee, whose brother, Mr. George Mitchell, came to Dundee from Alloa, and Mr. L. Farquhar (the Secretary of the Scottish Junior Gas Association, Eastern District) was appointed Assistant at Alloa. Mr. John Ireland moved from Auchterarder to Moffat, and Mr. William Mann, from Broughty Ferry, filled the vacancy. Mr. James Beocher, of Kirriemuir, was appointed to Aberfeldy; and Mr. Lewis Bain, of the Outdoor Department of Fraserburgh, was given the management of the Cullen Gas-Works, which have been bought by Mr. J. W. Napier, of Alloa. Mr. John Harrower, of the Glasgow Corporation Outdoor Department, was chosen by the Hong-Kong Gas Company as foreman gas-fitter. Mr. David Fulton (the Secretary of the Scottish Junior Gas Association, Western District) was appointed Assistant at Helensburgh. The office of Burgh Chamberlain and Treasurer of the Gas Commissioners at Dunbar was given to Mr. A. C. Ramsay, who had formerly been at Laurencekirk.

Turning to water matters, the Aberdeen Town Council have had a long controversy over the question as to the scheme to be adopted, and whether the Avon, the Dee, or the Dye should be used for the supply of water in their districts. They decided to cover the Mannofield and Cattofield reservoirs at a cost of £25,385, and to call in Mr. Hogge, of Glasgow, to assist Mr. Roberts, their Water Engineer, in the proposal to use water from the River Dee; the Bill to take the supply from the River Avon having been rejected by the House of Lords.

The Edinburgh and District Water Trust appointed Messrs. J. & A. Leslie and Reid as their Engineers. This was considered inadvisable by many, as the firm were not to give their whole time to the business of the Trust, and it was felt that an Engineer should be appointed who would take charge and give his entire attention to the matter. In connection with the Glasgow Corporation water supply, Loch Arklet is now joined to Loch Katrine, at Inversnaid, by means of a tunnel. A new reservoir has been provided for Peterhead, and a new water supply for Gourock at a cost of £20,000. The Troon Town Council made arrangements for a supply of water to the Barrasie Garden Suburb; and the Dundee Water Commissioners are to introduce a better supply to Birkhall and Muirhead. Cowdenbeath has purchased from Dunfermline the water-works at Loch Glow for the sum of £10,500; and the Crieff Town Council have purchased a reservoir from Messrs. Callendar and Co. The Provisional Order relating to the Kirkcaldy District Water was read a first time, and the Dunbar Water Order Confirmation Bill was passed.

THE GAS SUPPLY OF MUNICH.

MENTION has already been made of the publication by the Corporation of the City of Munich of a commemoration volume or album, dealing with the gas and water supply of the city, a copy of which was presented to the members of the German Association of Gas and Water Engineers on the occasion of the meeting of the Association in Munich last June. The following account of the development of gas supply in Munich, and the equipment of the gas-works there, has been prepared from this volume.

PROGRESS UNDER MUNICIPAL CONTROL.

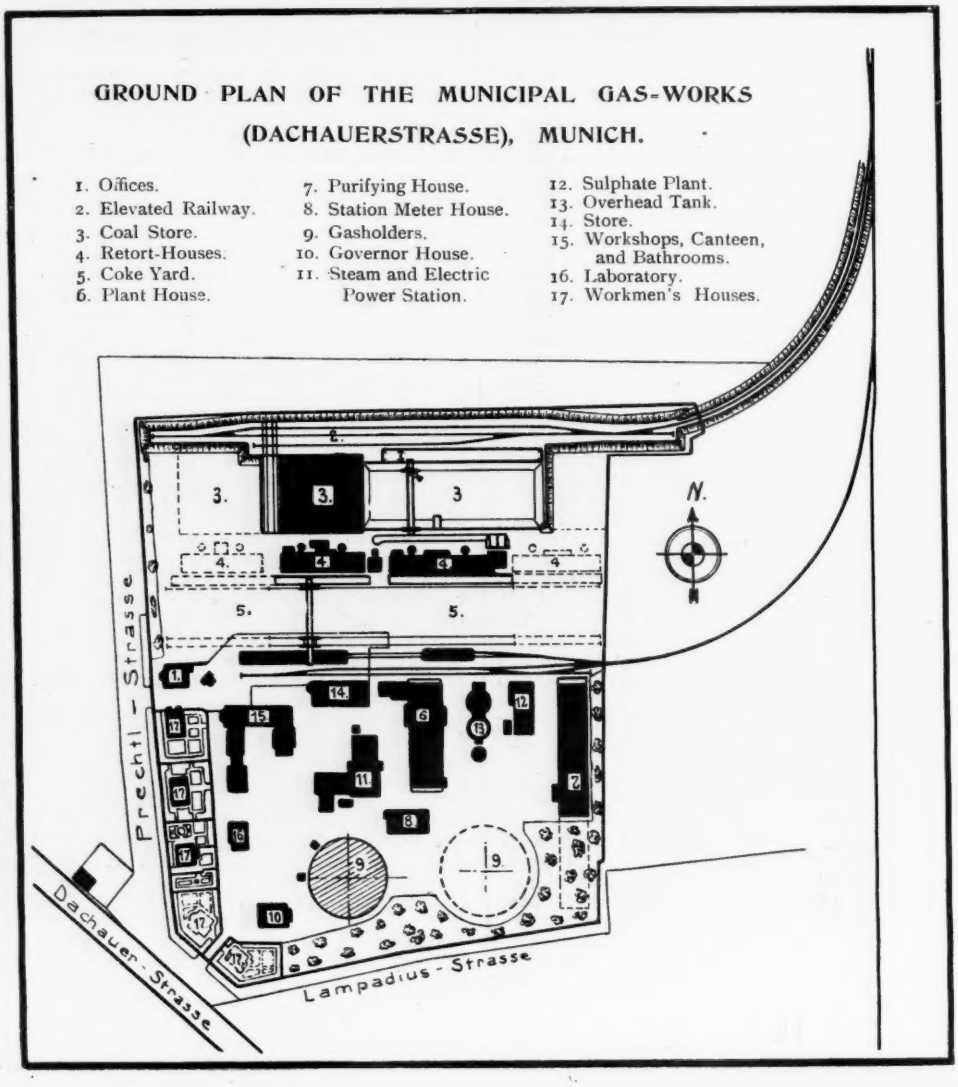
The gas supply of Munich was in the hands of a Company until Nov. 1, 1899, on which date the whole works' plant passed into the hands of the Corporation. Some years earlier, an agreement had been made between the old Company and the Corporation by which the former undertook to carry out the necessary extensions of the works and plant, and the Corporation to take them over at a fair price, in order that the development of the concern might not be arrested by the impending change of ownership. As a result of this agreement, all the required extensions were made at the new works at Kirchstein, which had been opened in 1883, and no further developments were made at the old works in Thalkirchnerstrasse, which were erected in 1850.

The increase in the consumption of gas in Munich between the years 1890 and 1900 was comparatively small, owing to the introduction of the incandescent burner and the extension of electric lighting. The increase in the use of gas for cooking and heating purposes, which at that time was taking place in other towns, did not occur in Munich, because the old Company was not interested in developing a class of business from which, owing to the expiration of their concession, they would not reap the benefit. About the time of the expiration of the concession, the new Municipal Central Electricity Works were opened. The conditions continued unfavourable to the development of gas supply in Munich for some time after the Corporation acquired the gas-works; and in the year 1901 there was actually a decrease in the output. From the year 1904, however, the Corporation set aside considerable sums for developing the supply. Service pipes and prepayment meter supplies were put in free of charge; and cooking, heating, and lighting apparatus were lent on hire at low rents. From this time onwards, the development of gas consumption has been very marked. The numbers of gas-meters and of gas consumers have considerably more than doubled between the years 1904 and 1911.

In 1890, the town possessed two gas-works—viz., the old one in Thalkirchnerstrasse, which had been raised to a maximum productive capacity of 1,400,000 cubic feet per diem, and the works at Kirchstein, which, since they were started in the year 1883, had been extended to a productive capacity of 3½ million cubic feet per diem. These works being no longer adequate to meet the increasing consumption, it was decided, in May, 1903, to erect new works, the construction of which was actually begun in the spring of 1906. Gas manufacture was started on them on April 23, 1909. The old works in Thalkirchnerstrasse were put out of action on June 1, 1909, and demolished shortly afterwards. The site was utilized for the administrative offices of the Gas Department.

Kirchstein Works.

These works, which had been planned by the late General Manager, Dr. N. H. Schilling, comprised four sets of plant having an aggregate daily productive capacity of 3½ million cubic feet. The carbonizing plant in the year 1908 consisted of forty-four settings—some of eight and some of nine horizontal retorts, with Munich producers. The Manager (Herr Hans Ries) had, however, in 1902-3, decided to erect at these works an experimental setting of three carbonizing chambers, in which the charge should be worked off in twenty-four hours. After protracted trials and many alterations, satisfactory results were obtained with this setting; and the Corporation decided to erect at the same works a bench of five settings of these chambers in place of six old



GENERAL VIEW OF THE COKE-HANDLING PLANT—SHOWING THE FINISHED RETORT-HOUSE AND THE SECOND HOUSE UNDER CONSTRUCTION.

retort-settings. The first of these settings was brought into regular use on Oct. 3, 1906. The results obtained, after a few slight difficulties had been overcome, were good; and from Feb. 7 to 16, 1907, a trial run was undertaken by the Instructional and Experimental Works of the German Association of Gas and Water Engineers, the results of which have already been reported. [See "JOURNAL," Vol. C., pp. 438 and 501.] These settings, apart from ordinary interruptions for cleaning and renewal of parts, have remained continuously in action from the year 1906 to the present time. The whole of the retort-settings on the Kirchstein works will gradually be replaced by large carbonizing chambers of the same type. In 1911, two sets of water-gas plant, each of 700,000 cubic feet productive capacity per diem, were erected at these works, and were brought into action in April last.

THE ORIGINAL METHOD OF DISCHARGING A MUNICH CHAMBER-OVEN AT THE KIRCHSTEIN GAS-WORKS, 1906.

Dachauerstrasse Works.

A fuller description is given of these works, on account of their more recent construction and more modern equipment. The works have been projected for a daily productive capacity of 10½ million cubic feet. The site of the new works was chosen for several reasons, among which may be named the extension of the city towards the north and west, and the possession by the Corporation of land in that quarter, and the convenience of railway communication at the Moosach station, which is 2½ miles from Munich. On the other hand, the works would not immediately be surrounded by dwelling houses, because on one side there were extensive exercise grounds for the military. The soil was diluvial gravel, suitable for the production of concrete; and the level of the underground water was about 13 feet below the surface. The water was quite good for works' use. The area available for the works, including railway sidings, was 34 acres. It adjoins a main thoroughfare, under which large mains to the town could be laid.

The buildings and plant on the works have been so disposed that the coal-store and carbonizing plant are on the north side, which is the farthest from the town. The gasholders and distributing governor are on the south side, nearest the town. The purifying and liquor plant have been installed on the east side of the works in view of the prevailing wind being west. In front of the carbonizing houses extends from west to east a wide coke yard, with plant for breaking, screening, and conveying the coke. The resident workmen's houses are on the west of the works. The general disposition of the works' buildings and plant is shown in the block plan. The ground level of the works is 1672 feet above sea level, and 28·6 feet below the porch of Munich Cathedral.

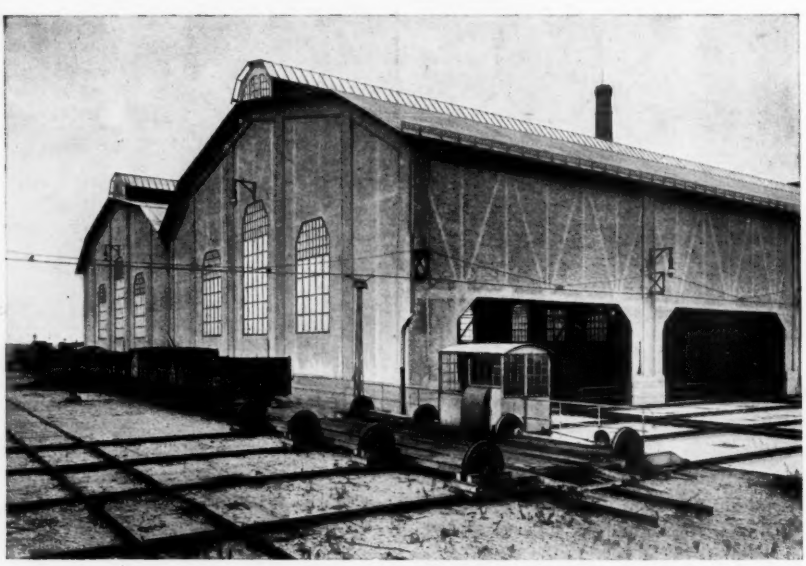
Originally the works were intended, when completed, to have a productive capacity of 10½ million cubic feet per diem, or about 2120 million cubic feet per annum, divided into three sections, each of 3½ million cubic feet per diem capacity. It appeared better, however, when the construction was put in hand, to provide only two completely independent sections, each of 5¼ million cubic feet per diem capacity. So far as the coal-store and carbonizing plant were concerned, however, these two sections were to be divided into two subsections, each of 2,625,000 cubic feet capacity per diem. This subdivision extends also to the purifying plant and meters. On the other hand, the condensing and washing plant is in two sections, each for 5¼ million cubic feet per diem. A reserve set of plant, however, of the same size is provided, which can be used for either of the sections if the plant for one of them has to be put out of action. Space is allowed for two gasholders, of which the first is of 2,625,000 cubic feet capacity, while the second will hold 5¼ or 7 million cubic feet.

Work of Construction—First Stage.

The first stage in the work of construction comprised the erection of a store for 18,000 tons of coal; carbonizing plant consisting of twelve settings having an output of 2,625,000 cubic feet of gas a day; apparatus, purifying, meter, and governor installations for twice this capacity; a steam and an electric power station, water wells with a water-tower for the supply of the whole works; and, finally, a gasholder of 2,625,000 cubic feet capacity. The buildings for the apparatus, meters, and governors were erected of a size large enough for the plant for the whole works; so that no subsequent extension of these buildings will be required. The stores, shops, canteen, bathrooms, offices, and laboratory have also been made large enough for the works when extended to its full capacity. The construction was started in 1906, and six beds of carbonizing chambers were brought into action on April 23, 1909, and the remaining six beds later. The rapid increase in gas consumption rendered it necessary to undertake extensions, and a second carbonizing house with coal-store and coal and coke handling plant was put in hand last year.

Railway Transport.

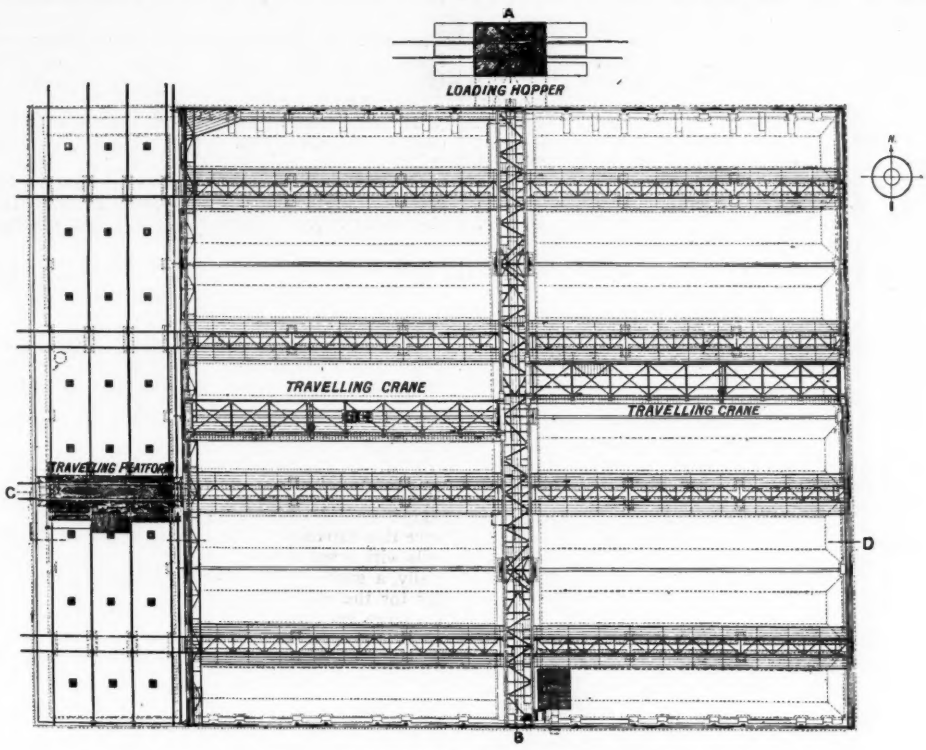
The works' railway lines were designed so that the incoming coal traffic should be completely separated from the outgoing products traffic and the incoming of materials. The delivery charges being independent of the height of the tracks on the works, it was decided to avoid the use of coal elevators by carrying the lines on to viaducts, especially as ample material was available for making embankments, &c. Two single tracks from the branch line which is provided for the military and the gas-works, enter the works—one, having a curve of 590 feet radius and an incline of one in 50, rises to an embankment at a level of 18 feet



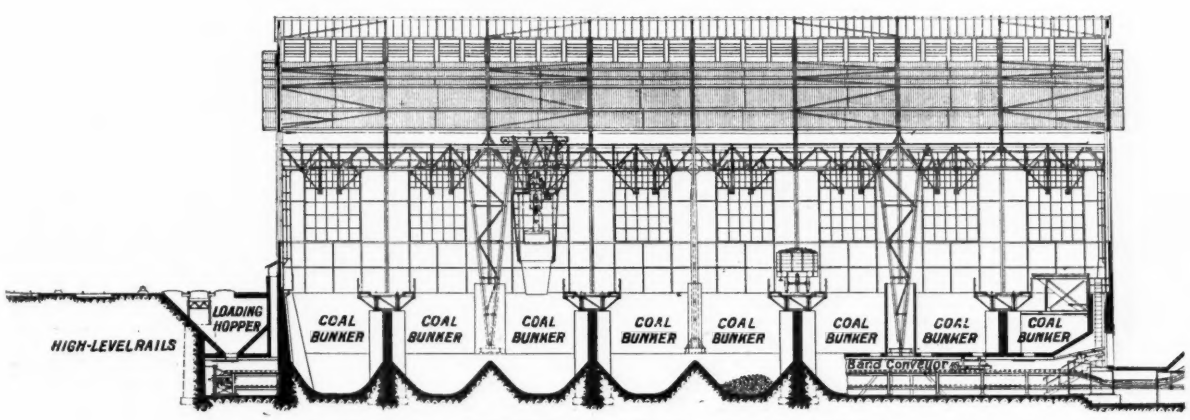
COAL-SHEDS WITH TRAVELLING PLATFORM.

above the ground level of the works, and the other, intended for handling the coke, tar, gas liquor, and purifying and constructional materials, is on the ground level. On the embankment there is the arrival line, a return siding, and a branch by which the trucks are distributed to the coal-sheds.

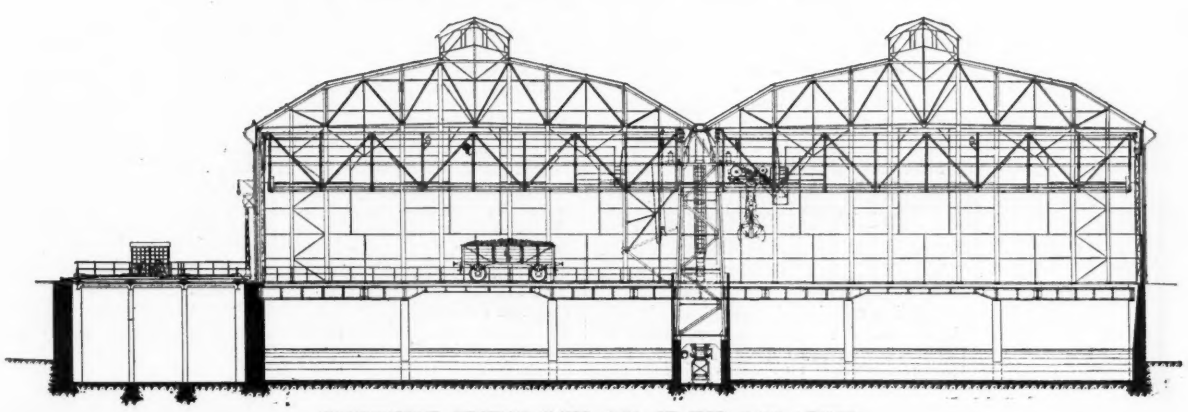
In the distributing branch line, there is a waggon-weighing machine (weighing up to 60 tons), as well as a turn-table 26 ft. 6 in. in diameter. The weighing machine is raised and lowered by means of a 2½ H.P. electric motor, with automatic cut-out. The turn-table is actuated by hand, and will be used for turning round the waggons to the waggon tip. To the west of the coal-store the railway lines are crossed by the rails for the traversing table or travelling platform. The ground level railway connection divides inside the works into two separate tracks. A waggon-weighing machine, to weigh up to 30 tons, is interposed in the arrival track. The waggons are shunted on the rails by means of capstans, which can be worked by one man, as the end of the rope coming from the capstan is automatically wound up by the drum of the capstan. The shunting capstans have a pull of 1½ tons, and move the waggons at the rate of 2·3 feet per second. They can, on the level, draw twelve loaded and about twenty empty 15-ton waggons. They are driven by an electromotor of 18 H.P., with helical transmission to the capstan drum. One shunting installation has a range in all directions of 650 feet.



PLAN OF THE COAL-STORE.



LONGITUDINAL SECTION (LINE A B) OF THE COAL-STORE.



TRANSVERSE SECTION (LINE C D) OF THE COAL-STORE.

There are two such installations on the elevated coal delivery tracks and one on the ground level line.

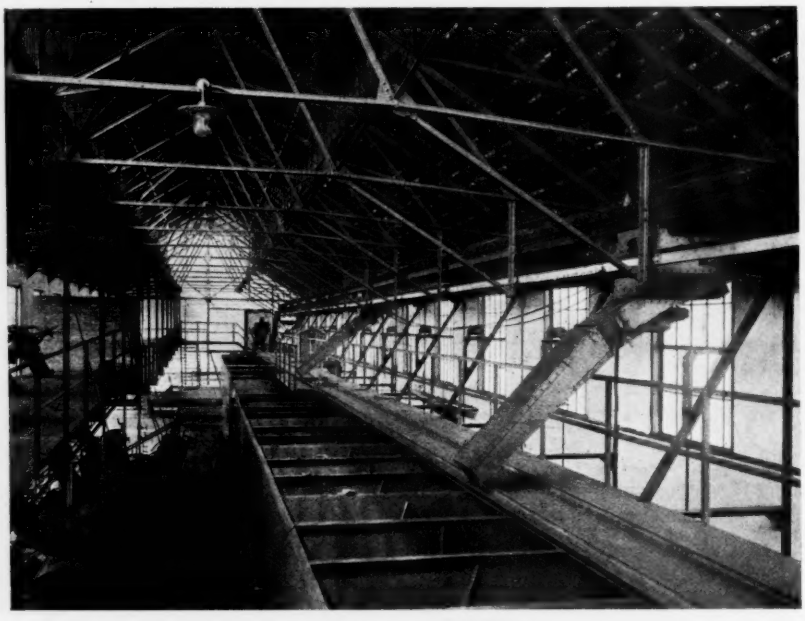
Coal-Store.

The coal is stored unbroken in a covered shed. The waggons arriving on the elevated railway line are drawn by a capstan on to a travelling platform, by which they are taken on one of four lines into the store, where, for the time being, they are discharged by hand into the bunkers. The available length of the travelling platform is 41 feet, and it will carry 60 tons; so that the largest waggons at present in use can be dealt with on it. It is actuated by means of a 21 H.P. electromotor. For economy of space, the projecting ends of the travelling platform are made to fold up by means of winding gear which is coupled with the travelling mechanism; so that the platform cannot be set in motion until the projecting ends have been drawn in. The travelling platform is capable of delivering ten loaded waggons per hour on to the tracks in the coal-store, and of bringing back ten empty waggons. Two men are required to work the travelling platform and shunt the waggons. The waggon-tip, which will shorten the time spent in discharging the waggons and displace labour, is being introduced in the second stage of construction of the works. The coal-store is 230 feet both in length and width overall, and is divided into sixteen bays or bunkers, each capable of holding about 1125 tons. The total storage capacity is therefore about 18,000 tons. The concrete bottoms of the bays are inclined, in order to facilitate emptying. The inside bays are separated in pairs by heavy concrete walls, which serve to carry the elevated tracks.

Transmission of Coal to the Carbonizing House.

The coal is removed from the bunkers in the coal-store by means of grabs attached to two cranes travelling at a height of 20 feet above the railway tracks. The cranes travel in the store in a transverse direction to the railway tracks; while the carriages for the grabs travel in the same direction as the railway tracks. The two travelling cranes are each driven by a 6 H.P. electromotor at the rate of 0·65 foot per second. The electrical equipment is arranged so that the grab carriages cannot pass from one crane to the other unless both are exactly in line. The grabs are of Pohlig's single-rope type, and are raised and lowered by a 40 H.P. electro-motor at a rate of 2 feet per second. The grab is opened by the dropping of a ring. The weight of a grab empty is 1·9 tons, and it holds, when filled with large coal, about 0·9 ton. The grab carriage is driven by a 6 H.P. electro-motor at a rate of 5 feet per second. The coal-handling plant in the coal-shed is capable of dealing with 40 tons per hour, and requires one crane driver to work it.

In the middle, underneath the coal-store, is an iron and concrete passage, running crosswise of the railway tracks, in which a steel-band conveyor runs. There are sixteen openings, 32 inches square, in the roof of this passage, through which the coal delivered by the grabs is fed through a device, actuated by the



THE COAL BUNKERS WITH FILLING SHOOT.

conveyor, on to the latter. The band conveyor is 230 feet in length, and is worked by a 9 H.P. motor at the rate of 0·65 foot per second. It conveys the coal to the breaking and screening plant attached to the carbonizing house. Coal can also be discharged from waggons on the embankment through a discharging pit direct on to the band conveyor. The conveyor delivers the coal on to a screen, which separates lumps over 3 inches in size and delivers them into two breakers, where the larger lumps are reduced to a size of 2 to 3 inches.

The broken coal and that which passes through the first screen then fall on to the receiver of a Hunt's conveyor. The first screen is worked by gearing from the band conveyor, and each of the two coal-breakers is driven by a 15 H.P. motor. Dust is extracted from the conveyor passage and the coal-breaker house by suction by a "Sirocco" fan, which is driven by a 7½ H.P. motor, and is delivered into two centrifugal cyclones arranged in series, in which the coarser particles are separated and the finest dust is discharged through a shaft over the roof of the carbonizing house. The Hunt's conveyor, with buckets of a little over a bushel capacity, carries the coal into the bunkers above the settings, where the buckets are discharged automatically. This conveying plant, like the band conveyor and the breakers, has a capacity of 40 tons per hour. The Hunt's conveyor is driven by a 15 H.P. alternating-current motor. Before the coal is discharged from the buckets it passes over an automatic registering Denisson weighing machine, the error of which is ±2 per cent.

Carbonizing Plant.

The carbonizing house contains two benches, each of six settings, of Munich carbonizing chambers. One bench commenced work in April, 1909; and the other in the spring of 1910. The construction of the latter had been delayed in order to profit by the experience gained with the former, and as a result the charging of the chambers of the second bench of settings is effected through a horizontal opening on the top, whereas the charging in the first six settings was through vertical doors at the back of the chambers. Further, the heating flues in the new settings are carried slantwise in the four walls; while in the first bench the heating flues went vertically upwards in the middle walls of the setting, and, going over the tops of the two outer chambers, passed vertically down the outer walls of the side chambers.

Charging from the top has considerably diminished the labour, and given the men more room. The abolition of heating at the top has considerably diminished the deposition of scurf on the roofs of the chambers. The hydraulic main has been shifted nearer the discharging side of the bench and set lower, so that the ascension pipes are reduced in length and a spacious level platform is provided on top of the settings. These variations have proved of such great advantage that, after two years' working, the first bench of settings has been altered accordingly, so that now all twelve settings are alike.

The producers are outside the settings on the charging side. The furnace or clinkering floor is 8 inches above the ground level. Each six settings have one main flue, which runs underground in front of the producers and leads to a chimney, 180 feet in height and 4·6 feet in diameter at the top. Some of the producers are fitted with ordinary grates and water-pans, and the others with step-grates without special water evaporators. The producers are charged from a charging platform, 23 feet above the furnace floor, by means of an electrically worked tramway. One charging of the producers suffices for twenty-four hours' work. The recuperative passages begin a foot above the ground level, and are designed so that the flue gases will pass into the main flue at a temperature, on the average, of 750° to 930° Fahr. The primary air in the producers with ordinary grates is pre-heated to about 930° Fahr.; whereas with the step-grates it enters the producers without preliminary heating.

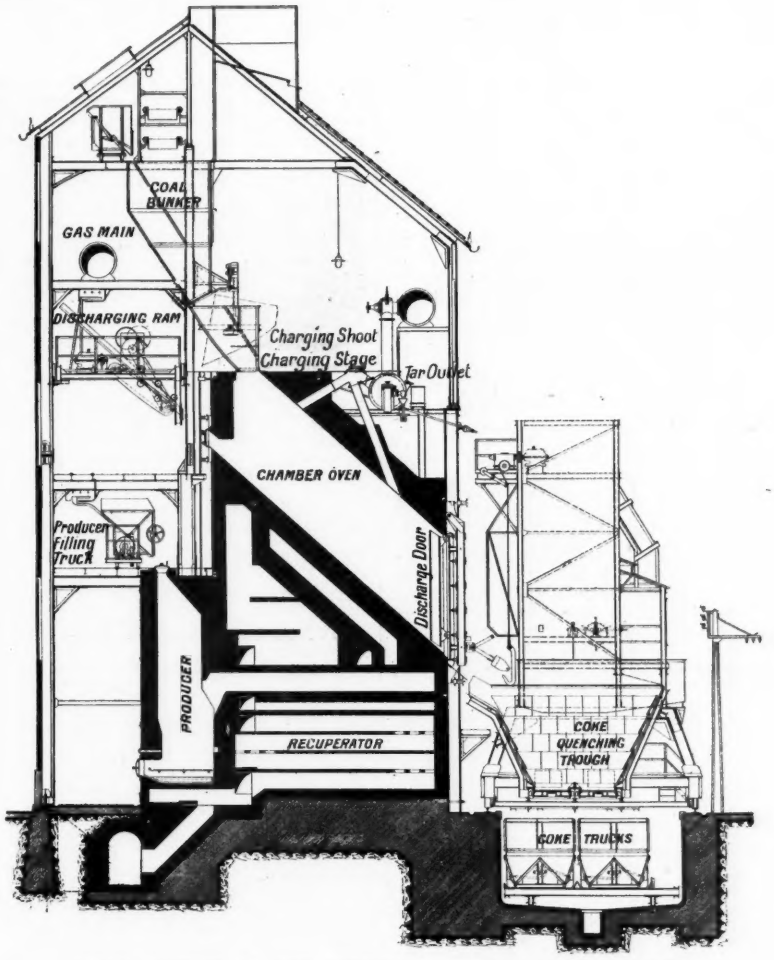
Each setting comprises three inclined carbonizing chambers,

11 ft. 6 in. in height, 1 ft. 6 in. in average width, and 21 ft. 4 in. in horizontal length. Each holds 16 to 17 tons of coal. The producer gas is burned in the four walls of the chamber by air which has been pre-heated to 1650° Fahr. The temperature of the walls of the chamber averages 2010° Fahr., diminishing uniformly towards the charging side. This temperature suffices to complete the carbonization of the charge in twenty-four hours. Special attention was paid to the construction of the discharging doors, which give a clear opening of 11 ft. 6 in. by 1 ft. 10 in. The doors are of wrought iron, and are forced on to the cast-iron framing by means of a cross-bar and eccentric. The cross-bars and doors are not rigidly connected, so that the eccentric presses the doors perfectly uniformly on the framing.

In order to dispense with labour, the horizontal eccentric is turned by a heavy weight and two hooks on the axis of the eccentric grip-pins on the door-framing. The attendant has, therefore, merely to switch on and off the hoisting motor in order to open and close the doors. In case the slab of coke, when the discharging door is opened, does not for any reason (such as the occurrence of scurf) fall out automatically, a ramming door is provided on the charging side by which an iron ram, driven by a motor, can be introduced, and a light push from which sets the slab sliding out. The chambers are charged through the horizontal opening by a shoot attached to the coal-bunker, from which the coal runs into the chamber in a short time.

Two ascension pipes, each 10 inches in diameter inside, convey the gas from each chamber to a separate cylindrical receiver in which a dip is provided during discharging and charging, but during carbonization the receiver works without dip. A group of six receivers is joined-up by 12-inch connections (with valves) to a foul-gas main 32 inches in diameter. Half of the twelve settings are discharged in the morning from 6 to 8 o'clock, and half in the evening from 4 to 6 o'clock. Four men are required for one shift for this work. The distribution of the discharging thus provided for suffices to produce a crude gas of sufficiently uniform calorific power.

The discharging and re-charging of a chamber are readily completed in from four to five minutes. The operation is conducted in the following way: Before discharging, the dip is closed and the discharging door opened; a light being applied. The coke slides out into the quenching machine, and after cleaning the frame the discharging door is closed. The gas take-off pipes are cleared, the lids put on, the coal run into the chamber, the charging door closed, and the dip raised. When the setting is charged, nothing else has to be done for twenty-four hours. Stoppages of the ascension pipes are very rare. Deposits of scurf on the walls



CROSS SECTION OF THE RETORT-HOUSE AND CHAMBER OVEN.

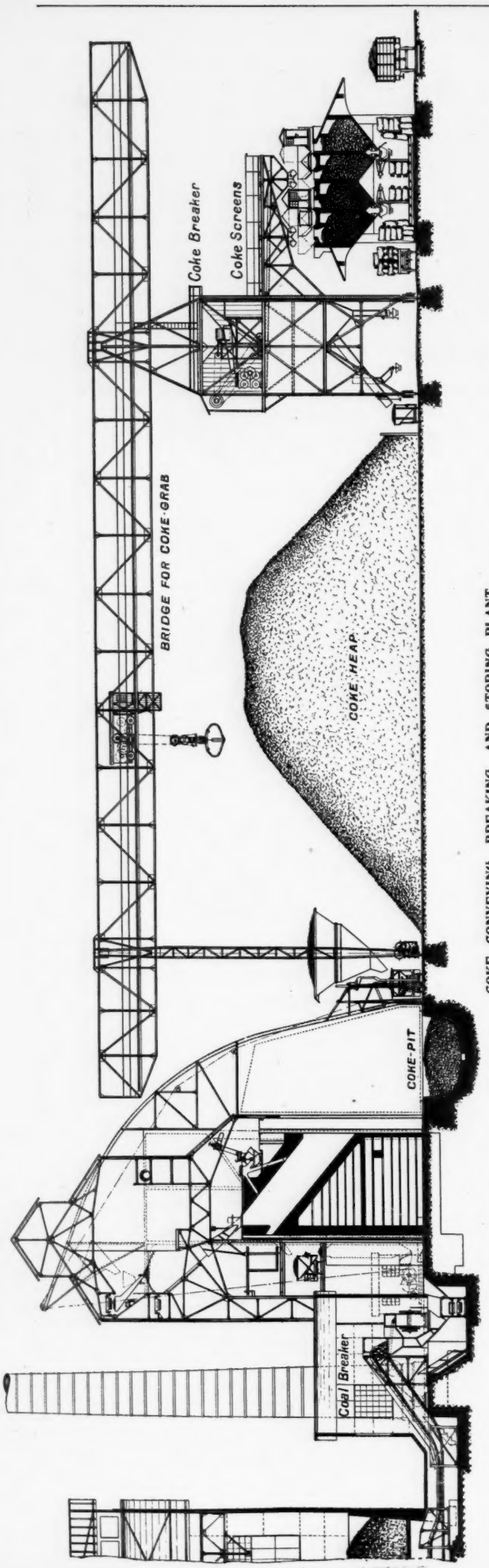
are removed once in from four to eight weeks; the time occupied in the removal being 20 minutes per chamber.

The settings have a length in the direction of the house of 13 ft. 9 in., a depth of 23 feet, a height of 42 ft. 8 in. The area covered by a setting, including the producer, is 380 square feet. The area enclosed in the house is 587 square feet per setting.

The Coke Plant.

The coke as it is discharged from the chambers, in quantities of about 4 tons 10 cwt. per chamber, is received in a quenching machine. The coke falls first into the large quenching trough, from which a feeding cylinder delivers it on to an inclined De Brouwer conveying trough, which draws it through the water and quenches it. The upper end of the conveying trough delivers it through an inclined shoot into the pit which runs in front of the retort-house. A chimney funnel above the trough and quenching conveyor discharges the steam and the fumes at a considerable height. The quenching machine also carries the apparatus for raising the discharging doors of the setting. This consists of mechanism placed above the quenching trough which causes the hooks attached to a wire rope to grip the cross-bar of the eccentric weight which closes the doors. The driver's box at the side of the quenching trough contains the various switches and the gear of the door-raising mechanism, which, simply by means of a coupling, also actuates the travelling gear of the quenching tower. The De Brouwer trough is driven by a direct-coupled electro-motor of 15 H.P.; and a motor of the same power operates the lifting and travelling machinery. The water required for quenching the coke is supplied through an automatic valve from a main in the retort-house to a reservoir above the driver's box of the quenching tower. The flow is regulated by a float.

The coke conveying, storing, and screening apparatus consists of a bridge crane which travels in front of the retort-house, having built in one of its columns the coke breaking and screening plant. There is also loading plant for filling sacks and waggons, and plant for charging the producers, comprising a hopper, elevator, and weighing machine. The coke-bridge is equipped with travelling Hone grabs of about 140 cubic feet capacity, which (worked by a single rope) remove the coke from the quenching pit and carry it either to the store heap or to the breaking and sorting plant. The same grabs serve also to transfer coke from the store heap to the breaking plant. The bridge is extended at



COKE CONVEYING, BREAKING, AND STORING PLANT.

the far end, so that waggons on the works' lines may be loaded direct from the grabs. The grabs are worked from an electrically driven drum equipped with a 60 H.P. lifting, and an 11 H.P. travelling, motor. The lifting speed is 2·6 feet, and the travelling speed 8·2 feet, per second. The attendant travels in the box attached to the crane. The grab is discharged by a ring in the same way as the coal grabs.

As the coke screening plant and bunker are erected inside the main column of the bridge crane, the load on the two columns is not equal. Consequently, each support of the bridge has a separate electro-motor for moving it. But in order to allow for difference in the rate of travel of the two supports, the bridge is not rigidly fixed to the columns. The light support, or pendulum of the bridge, may deviate 13 feet either way from the correct alignment. This column is driven by an 18 H.P. motor; while a 32 H.P. motor drives the main column. The bridge travels at the rate of 8 inches per second. The travelling mechanism is controlled by the driver who operates the grabs.

The coke passes from the hopper in the main column of the bridge through a mechanical distributor on to screens, through which lumps less than 4 inches in size pass. The larger lumps go to two double roller breakers, the teeth of which can be replaced, and the space between the rollers of which can be set at anything between $1\frac{3}{8}$ and 4 inches. A screen beneath the rollers separates the coke into six sizes. The two smallest sizes—viz., less than 1-5th and 1-5th to 2-5ths inch—fall into two receivers of about 5300 cubic feet capacity in the main support of the bridge crane, from which tip-waggons are filled. The four other sizes are conveyed by a jigging trough to a receiver on a projection from the bridge, from which they pass into two electrically driven waggons running over the sack-filling bunkers, either into these bunkers or into a receiver for filling waggons. The storage receiver, described later [see section on construction], is of reinforced concrete, and has a total capacity of 56,506 cubic feet. It has different openings for loading railway waggons or carts. The shed for sacks of coke will hold 6000 full hundredweight sacks, which are filled by thirty semi-automatic weighing machines.

The coke for the producers is drawn off from a bunker built in the smaller column of the bridge into a skip which rests on an electrically driven platform car, and is taken by an inclined elevator, driven by a 34 H.P. motor, into a reinforced concrete bunker, from which four waggons, each of about 53 cubic feet capacity, are filled for charging the producers. Two of these waggons are electrically driven; the other two being trailers. An automatic machine is employed to register the number and weight of the waggons required for charging the producers. The coke elevator is arranged so that it will serve in case of need for conveying coal to the bunkers above the settings; a smaller skip being filled in the coal-store and raised by the elevator into a charging bunker above the producer-coke bunker. It is then distributed into the bunkers of the settings.

(To be continued.)

Presentations to Eastbourne Gas Company's Officials.

The staff at the Central Depôt of the Eastbourne Gas Company recently gave a pleasant send-off to Mr. J. R. A. Phelps, on his taking up the duties of Chief Clerk to the Rugby Gas Company. Tea was partaken of in the stockholders' room, after which Mr. F. W. Garrard referred to the good feeling and unanimity which had prompted the parting gift to Mr. Phelps, by his former comrades, of a first-class silver half-hunter lever watch. The Secretary (Mr. James S. Garrard), in making the presentation, reviewed the past ten years of the busy and studious life of the recipient, and pointed the obvious lesson to the other members of the staff. Mr. Phelps, in acknowledging the gift, said he rejoiced at having so much goodwill and friendliness to take with him to his new sphere of duty. The watch contained the following inscription: "Presented to Mr. J. R. A. Phelps by the Central Depôt Staff, Eastbourne Gas Company, December 9th, 1912." Subsequently the members of the distribution department said farewell to one of their number—Mr. Edwin Stanley—who, after 25 years in the Old Country, is returning to his former occupation in Canada. Mr. W. J. Ball, the Superintendent, voiced the goodwill of the men, and the Secretary added a few words of appreciation of Mr. Stanley's work and of his tact and civility when engaged in his duties. In the name of his comrades, a solid silver cigarette-case was handed to Mr. Stanley, who, in returning thanks for the gift, promised ever to remember the kindly feeling and respect with which his departure had been associated.

At the ordinary meeting of the Royal Society of Arts on the 29th inst., Mr. Aneurin Williams will read a paper on "Co-Partnership;" and Sir Corbet Woodall, D.Sc., M.Inst.C.E., will preside on the occasion.

The current number of the "Journal of the Royal Society of Arts" contains the first of the series of three Cantor Lectures recently delivered by Mr. Charles R. Darling, F.I.C., on "Methods of Economizing Heat," and the others will appear in succeeding issues. The lectures have been noticed in the "Journal"—the third, bearing most closely on matters of special interest to our readers, being given at some considerable length in the number for the 24th ult.

GAS BILLS FOR 1913.

[First Article.]

While the session of Parliament that began nearly eleven months ago still continues, duty calls for the commencement of the review of the Gas Bills that have been lodged for promotion in the new session. In this opening article, we will deal with the five Bills of the companies that are seeking incorporation. But, before doing so, we may mention that it is proposed to drop reference to clauses that are now of common application, such as power to create special purposes and reserve funds, the adoption of the "Metropolitan" No. 2 burner, the modern auction clauses, and the prepayment meter clause, unless something that is a departure from the models is observed.

Taking the Bills in alphabetical order, the first to be noticed is that of the Ely Valley Lighting Company. The preamble informs us that there is no adequate supply of gas and electricity in a number of parishes in the county of Glamorgan, some of which parishes have quaint looking names. The area of supply lies on the borders of the districts of the Garw and Ogmore Company and of the Bridgend Company. The promoters are desirous of remedying the deficiency. It is proposed that the capital shall be £45,000 in £10 shares, with power to borrow £15,000, or the Company may "borrow from time to time not exceeding £1000 in respect of each portion of capital not exceeding £3000 issued." Land is scheduled for the gas-works and electric generating station. A maximum price of 5s. is contemplated; and 12 candles is proposed as the standard of illuminating power. A stand-by clause relating to both gas and electricity is included in the Bill. All the requisite powers for enabling the Company to prosecute the business of gas and electricity suppliers are included. It is stipulated that, if the Company do not, within three years from the passing of the Act, or within such extended period as the Board of Trade may prescribe, commence the supply of electricity, the authorized capital is to be reduced from £45,000 to £35,000. Separate accounts for the gas and electricity undertakings are to be kept. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

Also neighbours of the Garw and Bridgend Companies is the Llantrisant Gaslight and Coke Company, Limited, incorporated in 1867 under the Companies Act, 1862, and now applying for statutory powers. The nominal capital of the Company consists of £5000 in £5 shares, of which 673 have been subscribed, and are fully paid. The Company have issued debentures amounting to £2850. In addition, there has been expended a sum exceeding £3150 out of income. The Company now desire to enlarge their operations by raising additional capital, extending their works, and annexing fresh territory. The general purposes clause and the works clause of the Bill contain the limiting words "by them" after the words "manufacture of gas"—a restriction of liberty in dealing with residuals against which the Joint Committee who have been considering this matter have ruled. An authorized capital of £33,000 is contemplated, whereof £7000, divided into 1400 £5 shares, is called the original capital, and £26,000 the additional capital. The rate of dividend proposed on the original and additional capital is 7 per cent., and on the preference 6 per cent. The borrowing powers proposed in the Bill are (inclusive of the £2850 already borrowed) one-third part of the issued capital. Lands are scheduled for gas-works purposes. The standard price of gas is placed at 4s. 6d. per 1000 cubic feet, with the sliding-scale as to dividend operating half-yearly on the usual terms. The standard of illuminating power is suggested at 14 candles. There is a stand-by clause referring to both electricity and power gas. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Porthcawl Gaslight and Coke Company, Limited, have a nominal capital of £10,000 divided into 1000 shares, of which £8970 has been issued, and premiums have been received thereon amounting to £275. The Company have borrowed £2800. A structural valuation of the works, including £1000 working capital, is £15,228. It is submitted in the preamble that it is reasonable that shares or stock representing the amount of the sums expended on plant out of profits, and in the working of the undertaking, should be distributed among the shareholders of the Limited Company. The Company are asking for an extension of limits; and as they are supplying the parish of Newton Nottage, they desire the repeal of the powers of supply in that parish of the Llynvi Valley Gas Company. The promoters also submit that there is a demand for electricity in the district, and that they are in a favourable position for supplying it. It is intended, the Bill succeeding, to change the title of the Company to the Porthcawl and District Gas and Electricity Company. The capital sought is £63,000, of which £17,940 is to be the original capital, the remaining £45,060 being the additional capital. The Company take the right to convert into stock when the whole or part of the capital is fully paid up. The division of the original capital is proposed on the basis of two ordinary £10 shares for an ordinary one in the Limited Company. Inclusive of £2800 already borrowed, borrowing powers are asked for on the usual lines of one-third part of the issued capital. A standard rate of dividend of 6 per cent. is proposed on the original and additional capital, and at a similar rate on the preference capital. The standard price contemplated is 4s. 2d.; and the sliding-scale, it is suggested, shall operate half-yearly on the lines of 1s. 6d. per cent. change in dividend for every penny alteration of price. The Company are adopting the calorific value standard on the lines of the South Suburban standard [see "Journal," Oct. 15 last, p. 220]. The standard is 540 B.Th.U. gross per cubic foot. But if on any testing the calorific value is ascertained to be below 447 B.Th.U., a second testing is to be made on the same day at an interval of not less than an hour from making the first test; and the average of the two testings is to be deemed the calorific value of the gas that day. If on any one day the gas is of less calorific value than 475 B.Th.U. to an extent not exceeding 28 B.Th.U. the gas examiner is to make a testing on each of the two following days; and the average of the three testings is to be deemed to represent the calorific value of the gas on such one day. When the calorific value on any day is below 475 B.Th.U. gross, it is proposed that the following penalties shall apply: For any deficiency not exceeding 14 B.Th.U., 10s.; exceeding 14 B.Th.U. but not amounting to 28 B.Th.U., a sum not exceeding £1; and for each complete 28 B.Th.U., a sum not exceeding £2. The amounts of the penalties are less than are prescribed in the case of the more opulent South Suburban Company. A stand-by clause relating to both electricity and power gas is inserted. The electricity powers are in the usual form. If the Company do not begin the supply of current within three years, or such other period as the Board of Trade may prescribe, the additional capital is to be cut down from £45,060 to £36,060. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Titchfield Gas Company, Limited, was formed in 1865. The nominal capital is £5000—issued half as ordinary and half as preference £1 shares. The sum borrowed is £1600. Further capital and an extension of limits are required; and in the latter respect, it is asked that unexercised powers of the Gosport Gas Company in the parishes of Titchfield, Sarisbury, and Hook-with-Warsash may be repealed. As in the Ely Valley Bill, the general purposes and works clauses contain the restriction imposed on residuals dealings by the use of the words "by them;" and now the Joint Committee have reported against the restriction being imposed. The capital sought is £15,000—£5000 being divided equally between original ordinary and preference capital, the remaining £10,000 being additional capital. The standard dividend is proposed of 9 per cent. on the original ordinary capital and 7 per cent. on the additional ordinary capital, with 6 per cent. on the preference capital. The borrowing powers suggested are on the ordinary line of one-third part of the issued capital, including the £1600 already borrowed. The proposed standard price of gas is 4s. 6d. per 1000 cubic feet; dividends rising or falling with price reductions or increases of 1d. by 2s. 3d. per cent. on the 9 per cent. capital, and by 1s. 9d. on the 7 per cent. capital. The illuminating power of the gas is placed at 14 candles. A stand-by clause refers to both electricity and power gas. [*Parliamentary Agents: Messrs. Lees and Co.*]

The last Bill in the section is that of the United District Gas Company, which it is proposed shall issue from what is known as the Counties Gas Company, Limited. This concern was formed in 1911 for the purpose of acquiring the gas-works at Bicester, Buckingham, Adderbury, Cricklade, and Woodford. The Company subsequently purchased the works at Charlbury and Shipton-under-Wychwood. The nominal capital is £40,000, divided into 2000 ordinary £10 shares and 2000 £10 preference shares. Of the ordinary shares 1834 have been issued; and the whole of the preference shares have been taken up. The sum of £7000 has also been borrowed. Portions of the area supplied by the Company are within the parliamentary area of the Banbury Gas Company; and it is desired that the unexercised powers of the latter within the territory in question shall be repealed. The objectionable words "by them" [referred to in the Ely Valley and Tichfield Bills] appear in the general purposes and works clauses. The proposed capital is £48,000, consisting of the original ordinary capital as already stated, and £9600 of additional capital. The named standard rates of dividend are 9 per cent. on the original ordinary capital, 7 per cent. on the additional ordinary capital, and 6 per cent. on the preference capital. Including the £7000 already raised, borrowing powers are requested at the usual one-third rate of the capital raised. Compulsory powers are desired in respect of certain lands for works' purposes. A standard price of 4s. 6d. is proposed; and by half-yearly operations the dividend, it is intended, shall rise or fall with penny variations down or up, by 2s. 3d. per cent. on the 9 per cent. capital and 1s. 9d. on the 7 per cent. capital. The standard quality of the gas is placed at 14 candles. A stand-by clause includes both electricity and power gas. [*Parliamentary Agents: Messrs. Lees and Co.*]

Midland Junior Gas Association.—The members will meet next Saturday afternoon, in the City of Birmingham Technical School, to hear and discuss a paper by Mr. P. C. Balcon, of Birmingham, entitled "Technical Gas Analysis."

London and Southern District Junior Gas Association.—Arrangements have been made for a visit next Saturday afternoon to the Bromley-by-Bow works of the Gaslight and Coke Company. The members will assemble at the works' entrance, in St. Leonard's Road, at 2.45. On Friday, the 24th inst., there will be a meeting at the Westminster Technical Institute, when Mr. H. de P. Birkett, B.Sc., will read a paper (which will be illustrated by means of lantern slides, plans, and models) on the "Humphrey Pump."

COAL STATISTICS FOR 1911.

The Record Output.

THERE was issued at the end of last week Part III. of the annual Home Office Report and Statistics relating to Mines and Quarries for the year to Dec. 31, 1911. This particular Blue-Book is always awaited with a considerable amount of interest—containing, as it does, full particulars with regard to the output and values of coal both for the period specially reviewed and for previous periods. This, too, is not the only matter dealt with; for there are included in the report details with regard to all the minerals raised in the United Kingdom, the amount and value of the metals produced, and the exports and imports of minerals. The present Blue-Book, which bears the signature of Mr. R. A. S. Redmayne, the Chief Inspector of Mines, shows that the total output of coal mines and quarries during the year under review was substantially in excess of that of the immediately preceding twelve months; the value being also considerably more, though the average price per ton was slightly less. A diagram going back to 1873 indicates that on no occasion within the period covered has the output of coal exceeded that of the year 1911; the nearest approach to it having been in 1907.

The total quantity of coal raised in 1911 was 271,891,899 tons, of a value at the mines and quarries of £110,783,682—the figures for 1910 being 264,433,028 tons, of a value of £108,377,567; for 1909, 263,774,312 tons, value £106,274,900; for 1908, 261,528,795 tons, value £116,598,848; for 1907, 267,830,962 tons, value £120,527,378; and for 1906, 251,067,628 tons, value £91,529,266. There was thus an increase in 1911 as compared with 1910 of 7,458,871 tons in the output, and an increase of £2,406,115 in the value. As already remarked, the average price per ton of the coal at the pit was a trifle less—the actual figures being 8s. 1·79d. in 1911, as compared with 8s. 2·36d. in 1910. The value of the coal at the mines for each of the preceding four years was: In 1906, 7s. 3·49d. per ton; in 1907, 9s.; in 1908, 8s. 11d.; and in 1909, 8s. 0·7d. Thus in the six years named there have been three occasions—namely in 1910, 1908, and 1907—in which the approximate price realized averaged more than in the year now under review.

As to the large increase in output of 7,458,871 tons in 1911, this was derived from England, Wales, Scotland, and Ireland, though all except about 1,000,000 tons of it came from the English mines. That is to say, the increase in the output in England was 6,330,603 tons, Wales 740,475 tons, Scotland 383,031 tons, Ireland 4762 tons. The complete figures for 1911 were: England, 190,244,114 tons, of a value of £73,789,775; Wales, 39,845,058 tons, value £22,766,724; Scotland, 41,718,163 tons, value £14,178,310; and Ireland, 84,564 tons, value £48,873. The term "coal" as used in the statistics includes anthracite, the total output of which in the period under review was 4,350,479 tons, which was valued at £2,537,212. This is an item which exhibits a slight decrease as compared with 1910, when the output was 4,379,490 tons, of a value of £2,560,685. Of the total supply of anthracite, close upon 4,000,000 tons came from Wales; the contributions from Scotland and Ireland being small.

The prices of coal in 1911 at the pit's mouth in the different fields were as follows: In the Scotch coalfields, 6s. 9·57d. per ton; in the Northern coalfield, 7s. 5·08d.; in the Yorkshire, &c., coalfield, 7s. 5·34d.; in the Lancashire and Cheshire coalfield, 8s. 6·91d.; in the Midland coalfields, 7s. 2·73d.; in small detached coalfields, 8s. 7·25d.; in the North Wales coalfield, 8s. 4d.; in the South Wales coalfield, 11s. 2·42d.; and in the Irish coalfields, 11s. 6·71d. The average price per ton at the pit's mouth was for England 7s. 9·09d. per ton, and for Wales 11s. 5·13d.; the average over the whole of the field working out, as already stated, at 8s. 1·79d. The average price in the London market was 17s. per ton in 1911, compared with 16s. 3d. per ton in 1910, 16s. 11d. in 1909, 17s. 6d. in 1908, and 19s. 9d. in 1907.

The quantity of coal exported in 1911 (exclusive of coke and patent fuel, and of coal shipped by steamers engaged in foreign trade) was 64,599,266 tons, as compared with 62,085,476 tons in the preceding year—or an increase of 2,500,000 tons. In 1909, the exports were 63,076,799 tons; and in 1908, 62,547,175 tons. The declared value of the 1911 exports of coal was £36,521,068, and of those of the preceding year £36,099,560. In addition to this, there was in the period under review the equivalent of 1,766,460 tons of coal exported in the shape of 1,059,876 tons of coke, and the equivalent of 1,451,467 tons of coal in the form of 1,612,741 tons of manufactured fuel. Adding to this the 19,264,189 tons of coal shipped for the use of steamers engaged in foreign trade, there was a total quantity of coal and coal equivalent shipped of 87,081,382 tons. The declared value of the exports of coke was £792,076, and of manufactured fuel £1,134,210.

There is included a table which gives the places to which the coal and coal equivalents were exported; and this shows that the three largest customers, in the order of the quantity taken, were France, Italy, and Germany. For the preceding year, it may be remarked, the order of the three countries was France, Germany, and Italy; so that there is some change in the respective positions on the present occasion. In the period referred to in this Blue-Book, France took 10,448,537 tons, of a value of £5,636,762; Italy, 9,514,935 tons, value £5,638,428; and Germany, 8,980,041 tons, value £4,180,725. For the year 1910, the exports of coal, as such, to the three countries named were: France, 9,588,892 tons; Germany, 9,005,515 tons; and Italy, 8,784,504 tons. The figures revealing the other side of the picture—that is, the quantity and value of coal, coke, and manufactured fuel imported into the United Kingdom during 1911—are of an insignificant character. They are, in fact, even smaller than those for 1910, though somewhat larger than some which preceded that year. In 1911, the total amount imported was 30,187 tons, and the value £29,779; in 1910, 36,037 tons, value £34,119; in 1909, 6318 tons, value, £8297; and in 1908, 3842 tons, value £4689. While sending approximately 9,000,000 tons to Germany in 1911, we received from that country 10,690 tons. France, our largest customer, in return supplied us with 789 tons; while Belgium, who took about 1,750,000 tons, sent over to this country 9690 tons. From Australia there were received 5 tons, and from British India 4 tons. Out of the 271,891,899 tons of coal raised, the quantity remaining for home consumption for all purposes, after meeting all the requirements from abroad, was 184,810,517 tons; and reckoning the population of the United Kingdom at 45,311,078, this represents 4·079 tons per head—an amount which has been exceeded on only one occasion (and then but very slightly) since 1873. In 1910, the quantity which remained for home consumption was equal to 4·005 tons per head of the population.

The Production of Coke.

Subsequent tables furnish particulars with regard to the production of coke and briquettes, and the number of coking ovens in use, in 1911. Returns of production of coke were received from 147 colliery owners (comprising 206 separate works), 1431 gas undertakings, and 17 other owners of coke-ovens (comprising 18 works). The counties of Durham and York provided 68 per cent. of the total quantity of coke made in coking ovens—67 per cent. of the total number of ovens being worked in these counties. Of the 224 works (other than gas-works) where coking plant was in use during the year referred to, bye-products (the principal being sulphate of ammonia and tar) were recovered at 81—a figure which compares with 77 in 1910, and 71 in 1909. Returns as to the manufacture of briquettes were obtained from all firms known to have been engaged in the industry; South Wales being, as usual, by far the largest contributor in this respect. Very fine slack, otherwise of little value commercially, is utilized for the manufacture of the briquettes.

The total quantity of coal used in the manufacture of coke in 1911 is put at 34,460,640 tons; the amount of coke obtained being 18,957,279 tons (7,483,105 tons from gas-works, and 11,474,174 tons from coke-ovens), of a value of £12,446,250. These figures compare with an output the previous year of 7,406,346 tons from gas-works, and 11,925,115 tons from coke-ovens—19,331,461 tons. Of the gas-works output in 1911, 6,481,979 tons came from England, 147,952 tons from Wales, 672,829 tons from Scotland, 170,358 tons from Ireland, and 9987 tons from the Isle of Man. Of the 21,183 coke-ovens in use, 14,301 were of the bee-hive pattern; the next four in order being: Coppée 1904, Simon-Carvés 1244, Otto-Hilgenstock 1118, and Semet-Solvay 1107. There were produced 1,779,133 tons of briquettes, which were valued (the selling price at the place of manufacture) at £1,221,181.

Petroleum and Other Things.

Before leaving the Blue-Book, just a few figures may be quoted with regard to some of the minerals other than coal which are referred to. In the first place, it is noticed that the amount of bog ore taken from open workings in Ireland during 1911 was slightly greater than that returned for the previous year—2700 tons, of a value at the workings of £540, as compared with 2562 tons, valued at £640. The output of iron ore during 1911 was 15,519,424 tons, of a value of £4,035,893. This was 293,409 tons more than in the preceding twelve months. Possibly Mr. Edmund Eaton may like to make use in his share-pushing literature of the information given with regard to natural gas and petroleum in the United Kingdom. The references are short; and they should prove instructive to those whose interest he seeks to secure in connection with his financial projects. It seems that during the year 1911 the amount of natural gas obtained at Heathfield was 221,400 cubic feet, as against 262,000 cubic feet in 1910. With regard to petroleum, the statement is of an even simpler character: "Petroleum is not absolutely non-existent in Great Britain. A few years ago small quantities were obtained in North Staffordshire, Yorkshire, and Dumbartonshire; but since 1906 none has been obtained." The output of oil shale from mines and quarries in the United Kingdom in 1911 (all from Scotland) was 3,116,803 tons, of a value of £857,120 at the mines; the figures for 1910 being 3,130,280 tons, value £860,827. It is stated that the average yield of oil is 25 gallons, and of sulphate of ammonia 45 lbs., per ton of shale. Some of the seams worked are rich in oil, and poor in sulphate of ammonia; while in others just the reverse is the case.

The imports of petroleum in the year under review amounted to 365,639,477 gallons, of a value of £5,693,911, as compared with 345,469,836 gallons, value £5,662,882, during 1910. The sources of supply were: United States, 240,209,563 gallons; Russia, 43,592,889 gallons; and other countries, 81,837,025 gallons. The imports from Russia and "other countries" show an increase; but those from the United States were about 11,000,000 gallons less than in the preceding year. The value of the 1911 imports is given as: United States, £3,374,592; Russia, £681,817; and other countries, £1,637,502.

STATISTICS RELATING TO GAS UNDERTAKINGS.

Final Report under the Census of Production Act, 1906.

In the "Journal" for Sept. 5, 1911 (p. 600), we gave some statistics relating to the gas undertakings of the United Kingdom, extracted from the ninth, and last, of the series of tables summarizing the preliminary results of the returns received by the Board of Trade under the Census of Production Act, 1906. In the course of a report, addressed to the Secretary of the Board of Trade by the then Comptroller-General of the Labour Department (Sir G. R. Askwith, C.B., K.C.), it was pointed out that the statistics were to undergo revision before they were submitted in their entirety. This has now been done, and they appear in the final report—a very bulky Blue-book of nearly a thousand pages—which was issued last week. There are fourteen sections, the first consisting of a general report by the Director of the Census (Mr. A. W. Flux), summarizing the results of the returns, and the last being devoted to the public utilities services. In this section will be found the statistics relating to gas undertakings; and from it the following particulars are extracted.

Some Explanatory Remarks.

In the preliminary remarks, it is explained that the tables are based on returns received in respect of gas made by companies and public authorities for sale and for public lighting. Returns were not required from collieries, factories, and other establishments possessing plant for the generation of gas for their own use, except in the case of railway companies. The returns received in respect of the gas-works at the Royal Arsenal, Woolwich, and the Royal Small Arms Factory, Enfield, are included with those received from local authorities in the tables relating to public authorities. Separate tables are given showing the particulars furnished in respect of the undertakings conducted by companies, and in regard to those in the hands of public authorities.

Statistics of Output.

The following statement shows the particulars furnished as to the aggregate output of gas undertakings of both classes, and is free from substantial duplication. Some of the residual products may, it is remarked, have been purchased for working-up by several of the undertakings from others. It is believed, however, that any amounts so purchased were not large.

	Quantity.	Value.
Coal gas and water gas	(a)	£23,161,000
Coke and breeze	7,584,000 tons	4,434,000
Crude tar	654,000 ,,	666,000
Ammoniacal liquor	(a)	321,000
Ammoniacal liquor and crude tar, not separately distinguished	(a)	184,000
Bye-products—		
Ammonia, sulphate of	105,000 ,,	1,078,000
Anthracene	296,000 lbs.	2,000
Benzol and toluol	46,000 galls.	2,000
Carbolic acid	18,000 ,, / 18,000 cwt.	24,000
Naphtha	347,000 galls.	9,000
Naphthalene	44,000 cwt.	12,000
Pitch	85,000 tons	111,000
Tar (refined) and tar varnishes	642,000 galls.	6,000
Tar oil, creosote, &c	7,877,000 ,,	84,000
Other bye-products	(a)	169,000
Other products	(a)	27,000

(a) Recorded by value only.

The total value of the above-mentioned products amounts to £30,290,000, and is exclusive of the value of any gas and coke used in the gas-works where they were made. The crude tar and ammoniacal liquor included in the statement do not represent the total quantities made, but only the quantities not subjected to further treatment at the works where they were made. In addition, £1,321,000 was received from consumers for fixing stoves, fittings, &c., exclusive of the cost of the lighting, heating, or cooking apparatus fixed. The value of the total output of gas undertakings was thus £31,611,000.

Make of Gas.

Under the limitations imposed by the Census of Production Act, it was not possible to require the quantity of gas made to be stated in the compulsory part of the schedule. All companies and public authorities were accordingly requested to furnish a voluntary statement respecting the quantity of gas made by them. The great majority furnished this information. But some supplied particulars only of the gas sold; and companies and authorities that sold gas valued at £370,000 gave no particulars. After due allowance has been made for these deficiencies, it may be estimated that the total make of gas in the United Kingdom in the year of the return was as follows:

	Thousand Cubic Feet.
Statutory undertakings—	
Companies	118,665,000
Local authorities	69,845,000
Total	188,510,000
Non-statutory undertakings—	
Companies	7,095,000
Public authorities	682,000
Total	7,777,000
Grand total	196,287,000

The annual "Returns of Gas Undertakings" cover only those operating under statutory powers, and generally relate to the year 1907 in the case of companies and to the twelve months ended March 31, 1908, in the case of the local authorities. The output shown in these returns was 118,699,705,000 cubic feet in the case of companies, and 69,786,988,000 cubic feet in that of local authorities. The very small differences between these figures and those given above are due to the fact that in some cases the returns made to the Census of Production Office were not for the periods covered by the annual returns. According to these, the quantity of gas sold by authorized undertakings was 172,889,147,000 cubic feet; and, on the assumption that the relation between gas sold and gas made is similar for authorized and non-authorized undertakings, the total quantity sold and consumed in the United Kingdom in the year of return would be about 180,000 million cubic feet—the difference between make and sales being accounted for by gas used in works and leakages from mains. In addition to the gas made at public gas undertakings, railway companies stated in their returns that they made for their own purposes 1,411,496,000 cubic feet of coal gas at the cost of £146,000, and 441,931,000 cubic feet of oil gas costing £140,000.

Output of Residuals.

Taking into account foundry coke made at collieries, iron-works, &c., and gas coke made by railway companies and other manufacturers, the total output of foundry and gas coke and breeze (excluding coke used in the gas-works where it was made) in the United Kingdom in the year of return amounted to 20,064,000 tons, valued at £14,839,000. Ammoniacal liquor (including liquor and crude tar not separately distinguished) to the value of £587,000 was either sold or held in stock as ammoniacal liquor at all classes of works. The products of coal-tar distillation are dealt with in the report on the chemicals, coal-tar products, drugs, and perfumery trades.

The total output of sulphate of ammonia at all classes of works was returned to the Census Office as 264,000 tons. The Chief Inspector of Alkali Works, in his forty-fifth annual report, estimated that in 1907 "the recovery and production of ammonia in the United Kingdom, expressed in terms of sulphate," was the equivalent of 313,000 tons of sulphate of ammonia—adding that these figures "do not represent the produce of sulphate of ammonia." His estimate of the theoretical produce of sulphate of ammonia showed 165,000 tons from gas-works and 148,000 tons from other works, as compared with actual quantities of 105,000 tons returned to the Census Office as produced at gas-works, and 159,000 tons as produced at other works. There is thus a difference of 49,000 tons between the actual and the theoretical quantities of sulphate of ammonia. With regard to this difference, two points have to be noted. First, it appears from the report quoted that in 1908 it was discovered that there had been certain errors in the method of calculating the quantities for previous years, and that consequently the theoretical total for 1907 is somewhat over-estimated. Secondly, the principal difference between the two figures occurs in the produce of gas-works; and in addition to the 105,000 tons of sulphate of ammonia returned to the Census Office as produced at such works, there was also produced ammoniacal liquor valued at £321,000 (or, including liquor produced at other works, £403,000), and ammoniacal liquor and crude tar, not separately distinguished, valued at £184,000. This liquor was sold partly to alkali works for use in the production of alkali by the ammonia-soda process, and partly to other works making ammonia, and carbonate, chloride, and other compounds of ammonia. Particulars as to large quantities of ammonia and ammonia compounds were returned to the Census Office; but, in order to avoid the possibility of disclosing particulars relating to individual firms, they have not been shown separately, but are included in the group of "Unenumerated Chemicals" in the group of "Other Bye-Products," in the tabular statement already given. All such ammonia and ammonia compounds, as well as the liquor sold to alkali works, are included by the Chief Inspector in his estimate of their equivalent in sulphate of ammonia. Further, some sulphate of ammonia was probably worked-up by the makers into compound manures, and included as such in the returns made to the Census Office. Thus there appears to be no inconsistency between the figures of actual output of sulphate of ammonia as returned to the Census Office, and the estimate of the production of ammonia and ammonia compounds made by the Chief Inspector in terms of sulphate of ammonia.

The exports of coke in 1907 amounted to 981,000 tons, or nearly

5 per cent. of the total output in the United Kingdom. But the net imports—*i.e.*, the imports less re-exports—were only 18,000 tons. The exports of sulphate of ammonia amounted to 231,000 tons, or 89 per cent. of the total output; the imports are not separately specified. The exports and imports of other coal-tar products are dealt with in a separate portion of the report now under notice.

The net output of all the gas undertakings covered by the report is £17,287,000; this sum representing the total amount by which the value of the output exceeded the cost of the materials used, which was about £14,324,000.

Coal Carbonized and Capacity of Plant.

Gas companies and public authorities were asked to furnish a voluntary statement respecting the quantity of coal carbonized and the maximum capacity of their retorts as measured by the quantity of coal they could carbonize weekly. On the basis of the returns furnished, it is calculated that 16,203,000 tons of coal were carbonized for the production of 174,882 million cubic feet of coal gas, and that not less than 1800 tons of oil were used for gas enrichment. Further, 438,700 tons of coke and 238,100 tons of oil were used in the production of 21,405 million cubic feet of water gas. Companies and authorities producing more than 90 per cent. of the total output of coal gas stated that the weekly capacity of their retorts was 542,564 tons of coal carbonized, and that the total quantity of coal actually carbonized in the year of return was 14,714,300 tons. It is pointed out, however, that gas production is a seasonal industry; and, moreover, allowance should be made for the intervals during which retorts are under repair.

Companies.

The following statement shows the particulars furnished by gas companies respecting the output of their works, and is stated to be free from substantial duplication.

	Quantity.	Value.
Coal gas and water gas	(*a*)	£15,328,000
Coke and breeze	4,707,000 tons	2,968,000
Crude tar	369,000 ,,	366,000
Ammoniacal liquor	(*a*)	140,000
Ammoniacal liquor and crude tar not separately distinguished	(*a*)	18,000
Bye-products—		
Ammonia, sulphate of	73,000 tons	729,000
Anthracene	280,000 lbs.	2,000
Benzol and toluol	38,000 galls.	2,000
Carbolic acid	14,000 cwt.	20,000
Naphtha	57,000 galls.	3,000
Naphthalene	29,000 cwt.	11,000
Pitch	64,000 tons	88,000
Tar (refined) and tar varnishes	154,000 galls.	2,000
Tar oil, creosote, &c.	6,247,000 ,,	67,000
Other sorts	(*a*)	144,000
Other products	(*a*)	6,000

(*a*) Recorded by value only.

The total value of the above products amounts to £19,894,000, and is exclusive of the value of any gas and coke used in the works where they were made. As already stated, the crude tar and ammoniacal liquor included in the statement do not represent the total quantities made in companies' gas-works, but only those not subjected to further treatment at the works. In addition, the sum of £950,000 was received from consumers for fixing stoves and other fittings, &c., exclusive of the cost of the lighting, heating, or cooking apparatus fixed. The total value of the output of the gas undertakings conducted by companies was thus £20,844,000.

The companies were requested to furnish a voluntary statement regarding the quantity of coal carbonized and the maximum capacity of their retorts as measured by the bulk of coal they could carbonize weekly. Returns were received from companies producing 91·5 per cent. of the total gas output of the works owned by companies; and on this basis the following particulars were computed:

—	Make.	Used in the Production of Gas.		
		Coal.	Coke.	Oil.
	Thousand Cubic Feet.	Tons.	Tons.	Tons.
Coal gas	109,357,000	9,964,300	..	800
Water gas	16,403,000	..	330,900	186,400
Total	125,760,000	9,964,300	330,900	187,200

Companies producing 86·3 per cent. of the total output of coal gas by companies stated that the weekly capacity of their retorts was 324,875 tons of coal carbonized. and that the total bulk of coal actually carbonized in the year of return was 8,808,400 tons. It is again pointed out that gas production is a seasonal industry, and that allowance should be made for the intervals during which the retorts are under repair.

Public Authorities.

The following statement shows the particulars furnished by public authorities respecting the output of their gas-works, and is free from substantial duplication:

	Quantity.	Value.
Coal gas and water gas	(*a*)	£7,833,000
Coke and breeze	2,877,000 tons	1,466,000
Crude tar	285,000 ,,	300,000
Ammoniacal liquor	(*a*)	181,000
Ammoniacal liquor and crude tar, not separately distinguished	(*a*)	166,000
Bye-products—		
Ammonia, sulphate of	32,000 tons	349,000
Anthracene	16,000 lbs.	(*b*)
Benzol and toluol	8,000 galls.	(*b*)
Carbolic acid	18,000 ,, / 4,000 cwt.	4,000
Naphtha	224,000 galls.	5,000
Naphthalene	15,000 cwt.	1,000
Pitch	21,000 tons	22,000
Tar (refined) and tar varnishes	488,000 galls.	4,000
Tar oil, creosote, &c.	1,630,000 ,,	17,000
Other sorts	(*a*)	24,000
Other products	(*a*)	24,000

(*a*) Recorded by value only. (*b*) Under £500.

The total value of the above-mentioned products amounts to £10,396,000 and is exclusive of the value of any gas and coke used in the gas-works where they were made. The crude tar and ammoniacal liquor included in the statement do not represent the total quantities made in public authorities' gas-works, but only the quantities not subjected to further treatment at the works where they were made. In addition, the sum of £371,000 was received from consumers for fixing stoves and other fittings, exclusive of the cost of the lighting, heating, or cooking apparatus fixed. The value of the total output of the gas undertakings conducted by public authorities was thus £10,767,000.

As in the case of the companies, the public authorities were requested to furnish a voluntary statement in regard to the quantity of coal carbonized, and the maximum capacity of their retorts as measured by the bulk of coal they could carbonize weekly. Returns were received from authorities producing 98·8 per cent. of the total output of gas-works owned by such authorities; and on the basis thus afforded, the following particulars were computed:

—	Make.	Used in the Production of Gas.		
		Coal.	Coke.	Oil.
	Thousand Cubic Feet.	Tons.	Tons.	Tons.
Coal gas	65,525,000	6,238,700	..	1,000
Water gas	5,002,000	..	107,800	51,700
Total	70,527,000	6,238,700	107,800	52,700

Public authorities manufacturing 94·5 per cent. of the total output of coal gas from works owned by public authorities stated that the weekly capacity of their retorts was 217,689 tons of coal carbonized, and that the total amount of coal actually carbonized in the year of return was 5,905,900 tons. The remarks already made as to gas production being a seasonal industry are repeated in the foregoing connection.

[Further extracts from the report will be given in subsequent issues.]

THE SCIENCE OF ILLUMINATION.*

When Dr. Bloch sets out to instruct in the science of illumination, the pupil must remember that the instructor is a fervid exploiter of the art of electric lighting. It is not that Dr. Bloch's statements of principles and his demonstrations of physical laws are in any way incorrect, but that the examples of the practical applications of sources of light to illumination are selected so that the otherwise uninformed reader would suppose that electricity was *hors de concours*, both for public lighting and the illumination of interiors. Thus we find no record in the work before us of the high-efficiencies now obtained from high-pressure gas-burners. They are credited with affording a maximum duty of about 33 candles [? Hefners] per cubic foot, which was perhaps approximately correct in 1907 when Dr. Bloch's book on the "Science of Illumination" was published in German. But it is largely through the increase in duty to 60 English candles per cubic foot which has been realized in the interim that high-pressure gas-lamps have succeeded in displacing hundreds of electric arc lamps in the main thoroughfares of Berlin and London. Since the translator has made certain additions to the work, with the consent of the author, it was incumbent on both of them to see that the examples given of the energy consumption and yield of light for different illuminants were brought up to date—more specially in regard to gas lighting, with which the progress made in the past five years has been so enormous.

The text of Dr. Bloch's book is, for the most part, admirably

* "The Science of Illumination: An Outline of the Principles of Artificial Lighting." By Dr. L. Bloch, Engineer to the Berlin Electricity Works. Translated by W. C. Clinton, B.Sc., A.M.I.E.E., Assistant Professor of Electrical Engineering at University College, London. London: John Murray; 1912.

clear and succinct. He has not overloaded it with detail, and, consequently, the principles of illumination may be learned more readily and correctly from it than from any other work on the subject which has come before us. But when it comes to the applications of these principles to practice, the English reader must be careful to inquire exactly what the author and translator have done for him. There are numerous tables and diagrams, giving examples in terms of candles and their derived units. But unless we are mistaken, the candle throughout is the "Hefner," the "lux" is the German lux or "Hefner-metre," and the foot-candle is the "foot-Hefner" (except in Table XIX., which is quoted from an English source). It is true, as the author says, that all the other units are derived from the unit of luminous intensity. To Dr. Bloch this unit is the Hefner, and the derived unit of illumination is the German "lux" or Hefner-metre. The so-called "international" lux, or candle-metre, is 1·11 times as great as the German "lux;" and it is unlikely that, in the book before us, Dr. Bloch and Mr. Clinton mean anything but the German lux when they use the term "lux." If this is the case, Mr. Clinton is wrong in saying that 1 foot-candle = 10·76 lux, and in using this factor in the conversions from metric units into English units throughout his tables. Actually, 1 foot-Hefner = 10·76 lux; and 1 foot-candle = 11·95 lux. If we are right in our inference that the "candle" and the "foot-candle" in all the tables (except Table XIX.) in Mr. Clinton's translation are in reality the "Hefner" and the "foot-Hefner," we think he should ask his publisher to attach to all copies of the work sent out in future an explanatory note stating the fact, and giving the factors by which the conversion to the candle and foot-candle can be made. If we are wrong in our inference, and the candle, even in the metric-unit tables, is the English or so-called "international" candle, and the "lux" is in reality the "international" lux, it is almost equally desirable that this fact should be clearly stated.

Mr. Clinton's translation of Dr. Bloch's work is good so far as the text is concerned, and we hope that a call may be made for a second edition, in which he may clear up the confusion which at present exists as to the value of the units used in the examples and tables. We would suggest that he should then adopt for the English terms throughout the English candle (on which the so-called "international" candle is based) and the English foot-candle; also that he should follow the English practice of stating gas lighting duties in "candles per cubic foot," instead of "cubic-feet per candle." A very curious error indeed, for one who knows German as well as Mr. Clinton must, is the spelling met with on page 24 of the book and in the index as well—that is "Hefner-Kerz" for "Hefner-Kerze."

THE MANUFACTURE OF MANTLES FOR INCANDESCENT GAS LIGHTING.

By Dr. C. Richard Böhm, of Berlin.

No literature whatever existed on this subject up to about five years ago; and even in my book "Das Gasglühlicht," published in 1905, I was only able to give a comparatively short description of this rather intricate process of manufacture. For, firstly, as I have just said, there was no literature extant from which I could have gathered information, and, secondly, I did not at that time possess sufficient practical knowledge in this particular field. But soon afterwards I decided to devote myself to the practical study of this interesting industry; and since then I have embodied the results of much painstaking labour in an extensive work entitled "Die Fabrikation der Glühkörper für Gasglühlicht.

It goes without saying that the following short description regarding the manufacture of incandescent gas-mantles must be somewhat incomplete; so that for matters of detail I must refer the reader to the above-mentioned book. As regards the historical development of the industry, as well as the origin, preparation, and testing of the raw materials, these are questions which must here be left untouched. I have to restrict myself to what is most important from the practical point of view. But few of the readers of these lines will have the intention of producing the so-called stocking (*i.e.*, the impregnated web), which most of them will buy direct from the manufacturers—concerning themselves with the burning-off and the collodionizing only.

Knitting.

As regards the different kinds of web produced on the round-knitting machine, experience has shown that they possess the drawback of not having the pliability of mesh which is found in the ordinary web. This is the reason why the simple-knitted mantle has been able to hold its ground, in spite of the numerous special kinds of knittings and of woven mantles which for some time past have been on the market. While the cotton mantles appreciably decrease in brilliancy after only a short period of use, the ramie mantles are conspicuous for a long maintained constancy in this respect. The latter are superior to the former also as regards illuminating power, which even increases slightly when the mantle is first put into use. As regards the yarn, the Emmendingen is very much favoured on account of its evenness. The American manufacturers, who, until quite recently, exclusively employed cotton for making incandescent mantles, have also now decided in favour of ramie, as they are convinced that this material adapts itself very well to the particular kind of gas used in the States, which is entirely different from our own. The ramie mantle, although it is stronger than the one made of cotton, is, as regards strength, considerably inferior to the mantle made of artificial silk. The latter combines the advantages of the ramie mantle—viz., high and well-maintained illuminating power—with a perfectly remarkable elasticity of the ash skeleton found after the mantle is burned off.

The unforeseen difficulties which were encountered in connection with the introduction of ramie into the incandescent gas lighting industry were repeated, if not intensified, as regards the introduction of artificial silk mantles, although these difficulties seem by now to have been entirely overcome. Considerable pains and labour were spent in adapting the artificial silk used in the textile industries to the peculiar requirements of the incandescent gas-mantle. Some few German mantle manufacturers obtain their artificial silk from the "Vereinigten Elberfelder Glanzstoff-Fabriken" and the "Vereinigten Kunstseidefabriken, Frankfort," besides using the so-called copper-cellulose and Chardonnet silk; while the French Auer Company, who almost exclusively manufacture artificial silk mantles, use only the French viscose silk. The latter is not allowed to be supplied to their competitors, who, consequently, are confined to the use of Chardonnet silk.

It may here be stated that the quantity of artificial silk mantles produced is much greater in France than in Germany; but the general introduction of this type of mantle, combining, as it does, all the advantages of the various other types, may now be regarded only as a matter of time. The manufacture of incandescent mantles will then be considerably simplified, as the raw stocking made of artificial silk need not be washed, as is the case with both cotton and ramie webs. It is a known fact that the cotton and ramie yarns contain mineral impurities which alone—and quite apart from the fatty substances to be found in the fibres—would adversely affect the constancy of shape and, consequently, the maintenance of a uniform illuminating power.

Washing.

The washing is, as usual, carried out in two stages, of which the one is the alkaline and the other the acid stage. No definite formula applies in this connection, as the concentration of the baths has to be regulated according to the condition of the yarn. As a rule, the baths are made somewhat stronger for ramie than for cotton. Until recently, a 3 to 5 per cent. solution of soda was almost universally employed to remove the fat; while the mineral impurities were extracted by means of a 1 to 3 per cent. solution of hydrochloric acid. While the alkaline bath was invariably used warm, the question as to whether the acid solutions employed should be warm or cold is considered a matter of opinion. Of late, the process of washing has been greatly simplified, in so far as the ramie web is now soaked over night in a cold 2 per cent. solution of nitric acid. Next morning, it is centrifugalized, in order to remove the superfluous water, and is then treated with a weak solution of ammonia for the purpose of neutralizing the acid. The web should next be thoroughly washed—first with warm condensed water, and then with distilled water. By this methed of washing, which is carefully guarded as a secret by the manufacturers, excellent results are obtained. The percentage of ash can be reduced to from 0·015 to 0·02 per cent., provided that the instructions are properly followed. By still further reducing the quantity of ash, it has been found that a web of greater purity is obtained, to the detriment of the durability of the ash-skeleton.

Drying.

The drying of the washed web takes place at a moderate temperature either in drying-rooms or in the drying apparatus. In the former case, the lengths of web are hung over poles; while in the latter the wet web lengths enter a heated box from the one side and, after passing slowly in zig-zag line along a system of rollers, come out at the other end dry. The web is now cut up into pieces of from 8 to 10 inches in length; this being the size required for the manufacture of standard mantles. In order to avoid waste at the impregnating stage, the pieces are sorted into batches of 25, 50, or 100, which are labelled and packed into a clean, dry cardboard box. From this point in the manufacturing process onward, scrupulous cleanliness should be observed in handling the web, if satisfactory results are to be obtained.

Impregnating.

The impregnating is a comparatively easy process, by which the pieces of web, or the whole lengths of web (as, for instance, in the case of artificial silk mantles), are saturated with the impregnating solution or, as Welsbach used to call it, the lighting fluid. This so-called lighting fluid consists of a 25 to 33 per cent. aqueous solution of thorium and cerium nitrates in the proportion of 99:1. According to whether cotton or ramie web is to be

treated, small quantities of hardening media may be added, as, for instance, 0·5 per cent. of nitrate of beryllium, in order to give greater strength and lighting constancy to the ramie mantle. Nitrate of magnesium and aluminum, too, are hardening media, of which the former especially is extensively used instead of the comparatively expensive beryllium; the proportion added being about 4 per cent. In this case, however, the use of the sulphate is to be preferred to that of the nitrate.

While the cotton and ramie webs need only be left for one or two minutes in the impregnating fluid in order to become entirely impregnated, those made of artificial silk require about five hours. With the former, the superfluous fluid is removed with the aid of a wringing-machine; while in the case of artificial silk webs, a centrifuge has to be employed, the drum of which should be composed of china. The damp cotton or ramie stockings are then drawn on to drying glasses, when great care should be taken that the hands of the workers are absolutely clean. The stockings are then placed in a moderately heated room set apart for drying purposes. In the case of webs made of artificial silk, the whole lengths of impregnated web are run over wooden rollers in the drying apparatus.

Before the impregnating process is commenced, the following points should be clear: What kind of mantles are to be treated—*i.e.*, whether "standard" or "special" mantles—how long (*e.g.*, 4 inch), and how heavy (*e.g.*, 0·5 gramme) the burned-off mantle has to be. For this purpose, ten stockings of 8 inches each are cut off the standard length of web, and weighed together in a sensitive balance, when the total weight will be found to be (say) 35 grammes. Now, if each mantle is to receive about 0·5 gramme of oxide, the ten stockings should absorb 36 grammes of the solution, and, consequently, ought to weigh about 66 grammes after impregnation. In order to obtain this result, the wringing-machine should be so adjusted that the two rollers are just touching one another.

The fluid-dish (an elongated vessel made of either china, glass, or earthenware) is then filled three-quarters full with the impregnating fluid, into which the ten raw stockings are placed after being carefully laid on top of each other. The stockings must be entirely covered by the fluid in which the whole batch should repeatedly be turned over. After being in the bath for about one or two minutes, each stocking should be separately and evenly put through the wringer, whereupon the whole batch is again placed on wax-paper on the scales, in order to ascertain the increase in weight. Should the total weight exceed 66 grammes, the machine must be tightened; but, if the opposite be the case, it must be loosened. If, for instance, the weight of the ten impregnated stockings amounts to 75 grammes, the rollers should be so adjusted as to be a little closer together than before. The process is then repeated until the ten stockings have been reduced to the required weight of 65 or 66 grammes. They are now stretched over cylindrical drying glasses and dried at a normal temperature—30° C. at the most.

From one to four of these stockings should be dried quicker than the rest, at a somewhat higher temperature and, perhaps, in a current of warm air. After the heads have been sewn, the stockings are burned off and shaped for about two or three minutes on the compressed-gas burner, in order to ascertain the length which the mantle is going to assume. In case the mantles show a length of (say) $4\frac{5}{16}$ inches (11 cm.) instead of $3\frac{3}{4}$ inches (9·5 cm.), the length of the raw stocking should be reduced by about $\frac{5}{16}$ths to $\frac{13}{16}$ths of an inch, and at the same time the fluid supply should be regulated. Differences of 0·5 cm. may be neglected. After the proportions have been properly adjusted in this manner, the work of impregnating can be commenced; a second elongated dish being used for receiving the saturated stockings. Two active girls are able to impregnate from 10,000 to 15,000 stockings per day.

Below will be found some approved formulæ of impregnating fluid for ramie mantles:—

(1) 1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
10 g. Nitrate of cerium,
5 g. Nitrate of beryllium,
1·5 g. Nitrate of magnesium,
2 Kg. of distilled water.

(2) 1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
8 g. Nitrate of cerium,
2 g. Nitrate of beryllium,
1·5 g. Nitrate of magnesium,
2·4 Kg. of distilled water.

(3) 1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
10 g. Nitrate of cerium,
5 g. Nitrate of beryllium,
2·5 g. Nitrate of magnesium,
1·8 Kg. of distilled water.

(4) 1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
10 g. Nitrate of cerium,
6–7 cubic cm. beryllium solution of de Haën,
2·5 Kg. of distilled water.

(5) 1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
10 g. Nitrate of cerium,
5 g. Nitrate of beryllium,
2 g. Nitrate of magnesium,
1·6 Kg. of distilled water.

It is sometimes advisable to add some nitrate of beryllium to the cotton mantles, if it is desired to give them a certain shape, as, for instance, in the case of mantles for petrol lighting. Nitrate or sulphate of magnesium is to be recommended, especially for woven ramie mantles where the meshes are too wide. A cheap mantle may be produced by increasing the proportion of magnesium [see formula 3], whereby a hastening of the hardening, and consequently the burning-off, process is effected. For high-pressure gas-mantles a more concentrated fluid is, as a rule, chosen [see formula 5]. In the case of cotton mantles, only traces of the hardening media should be added—nitrate or sulphate of magnesium, according to the following formula, are especially to be recommended:—

1 Kg. Nitrate of thorium (48-49 per cent. ThO_2),
10 g. Nitrate of cerium,
1 g. Nitrate of magnesium,
2·5 Kg. of distilled water.

In the case of certain special webs, the use of hardening media will sometimes be found necessary.

Sewing the Tulle—or Patent Head.

In order to strengthen the part where the asbestos loop is fastened, it has been the practice to fold over the upper end of the web, either inside or outside. This is still done with cheap mantles, and also almost universally in the case of those of artificial silk. The asbestos thread is then drawn through this double layer of web, either by hand or by means of the Cohn machine, and tied into a loop. While this simple method of folding over can be suitably employed in connection with the so-called patent webs, the meshes of which gradually decrease in width towards the head, it is of advantage to use special tulle strips for strengthening the top of the web where the latter are cut from the length. Although this tulle head increases the cost per 1000 mantles by about 5 marks, as compared with the "patent" head, the former produces a much better shape.

Of late, tulle ribbons and gauze strips made to size have come into favour—for instance, those manufactured by Messrs. Thos. Adams and Co., Limited, of Nottingham (England), and Messrs. Frowein and Wiescher, of Barmen (Germany). The tulle and gauze strips should not be dressed; otherwise they will not absorb the impregnating fluid. Besides, dressing makes the strips unnecessarily stiff, with the result that they are more difficult to sew on, and that the heads obtained are less satisfactory in shape. The laying of the tulle or gauze strip round the web end or the turning down of the close-meshed patent head is effected by means of a tin cylinder resting on a wooden stand and having a wooden plug to fit its opening.

Most manufacturers sew the unfixed tulle or gauze strip on to the impregnated web; while some sew the tulle or patent head, as the case may be, on to the web before impregnating the latter. They also, in the case of inverted mantles, do not impregnate before the so-called spider has been made. Each method must have its advantages as well as disadvantages. As a rule, the tulle or gauze strips are worked in without having first been impregnated with the fixing fluid; but in the case of coarse webs—as, for instance, Hill webs—it is necessary to use fixed strips. One female sewer with two assistants is capable of turning out from 1000 to 1500 webs per day of ten working hours.

Sewing the "Spider" of the Inverted Mantle.

In order to obtain the highest possible lighting efficiency in connection with inverted incandescent mantles, their downward end should be of a semi-globular shape, and free from creases. This is a task demanding much care and great accuracy. Formerly, the sewing of the "spider" used to be done exclusively by hand. Now, however, the lower end of the stocking is, according to the Cohn process, tied together like a sack, and the knot or pad thus produced is turned inside. I was astonished to find that even the high-class mantles of the most renowned firms were sewn in this fashion. Skriwan, of Vienna, now uses sewing machines for making the spider. Stockings cut to size for inverted mantles have also lately been put on the market—for instance, by Frowein and Wiescher. If the sewing of the spider is done after the web has been impregnated, the sewing-cotton should also be impregnated, for which purpose the fluid rests might be used. The cost of sewing the spiders amounts to from 12 to 18 marks per 1000 mantles, according to the size and nature of the web. These figures can, however, be considerably reduced by employing the Cohn method of sewing.

Fixing the Mantle Head.

For the purpose of still further strengthening the heads of upright mantles, they are treated with what is known as the fixing fluid, consisting of a 50 per cent. aqueous solution of nitrate of aluminium and magnesium. In order to ensure a better and quicker calcination of the head, and also for colouring the latter, chlorate of potash, nitrate of ammonium, borax, nitrate of didymium, and nitrate of chromium are sometimes added, of which the latter two produce coloured oxides. The fixing of the head is carried out in many different ways, though the underlying principle remains the same in most cases—the felt pad soaked with the fixing fluid being the arrangement now generally adopted. At the outset, the fixing fluid was applied to the heads by means of a painter's brush, which method is still followed in isolated instances; or a number of stockings, generally about ten, after having been placed together, heads downward, were just passed over the surface of the fixing fluid contained in a dish.

Owing to the capillary action of the web fibre, the fixing fluid is quickly absorbed; marking its path as it rises by dint of the

organic colouring substance which has been added to the fluid—for instance, methyl blue. This method of fixing is, of course, rather crude, and for this reason new processes have been developed. For instance, there is the felt pad or several layers of blotting paper saturated with the fluid, whereby the absorption of the latter by the web can be more accurately regulated. Then there is a device—which, on account of its shape, may be compared to a nut-cracker—by which two felt-covered plates, one of which is soaked with fixing fluid, are pressed together; this being probably the most widely used fixing apparatus. Another apparatus, which can best be compared to a knife-cleaning machine, consists of two rotary discs covered with felt. It is much used by large firms for fixing purposes, as by its application the turnover is considerably increased.

Sewing the Asbestos Loop.

After the fixing comes the sewing of the head, or the making of the loop. The asbestos employed for this purpose must be long-fibred and of the best quality, and should be used with a slight admixture of cotton. Even if all these conditions are observed, it may still happen that flaws occur in the asbestos, against which there is no remedy, as they cannot be detected before the asbestos is worked in. They very frequently do not even show themselves till the collodionized mantle is being burnt off. Any flaw in the asbestos will entail the loss of a mantle, as the heat will cause brittleness at the weak spot, resulting in breakage.

When making the asbestos loop, the operator proceeds as follows: An asbestos thread, about 20 inches long, which suffices for three heads, is threaded into a blunt embroidery needle. This the operator holds with her right hand, and passes it first through the half of the head which has been laid in four plaits and, after pulling the needle through, then through the other half. The two ends are then tied into a knot, and, after being twisted together, are passed between the two rows of plaits, whereupon they are again tied to the thread; thus forming the suspending loop.

It is astonishing to what dexterity some operators attain in the sewing of the head and in making the loop. While a beginner may sew from 100 to 150 heads per day, many a skilled hand will bring the total up to from 500 or 600. For several years the sewing of the heads has been performed by machinery. The output can be very considerably increased by using a head sewing machine—for instance, the one constructed by Cohn. I would be wandering from my theme were I to explain the working of this machine here. The reader will find a full description of it given on pp. 223-7 of my book entitled "Die Fabrikation der Glühkörper für Gasglühlicht."

I will not leave unmentioned the efforts made in the direction of not only simplifying the sewing operation, but also of rendering the head stronger. The best known mantle produced with this object in view is that of Wasmuth, which is fitted with a metal head. Herr W. Mauer, of Berlin, also manufactures mantles with metal heads, similar to those with magnesia rings, which are being used with great success by Langhaus in connection with incandescent petrol lighting, as they appear to entirely prevent the flame sooting.

Finally, it may be mentioned that in America, Austria, and France, the mantles are not suspended on central forks, but on side-carriers. Where the latter are provided with a ring at the upper end, the mantle is fastened to it by two asbestos threads. The sewing for this type of suspension is called in Germany "Ringtriglichen," "ring-looping." A double loop (cross loop) is also used, chiefly with mantles for petrol light, and in England also for Block-light mantles.

Fastening the Inverted Mantle to the Ring.

The inverted mantle, which, at its lower end, is closed and of semi-globular shape, has at the open end to be treated with fixing fluid to the extent of 2-5th inch or 3-5th inch downward, and fastened to a magnesium or metal ring by means of which it is suspended from the burner. Care must be taken that the stocking is absolutely straight when fastened to the ring. In order to obtain evenness of the stocking all round, the rows of meshes are counted, commencing at the "spider." They should number about thirty with mantles of standard size. The open end of the stocking is now turned inwards to the extent of about 3-16th inch, and an asbestos thread (50-2, slightly paraffined and from 8 inches to 10 inches long) is drawn through this double layer of web by gathering-up the meshes at equal intervals.

This work, which until recently was done by hand, is now more easily performed by a small machine, likewise constructed by Cohn. [See Böhm, p. 235, *et seq.*]

(To be continued.)

The members of the Eastern District Division of the Scottish Junior Gas Association will, next Saturday afternoon, visit the coke-ovens of Messrs. William Baird and Co., Limited, at the Bedlay Colliery, Glenboig.

Mr. J. Alsop, the Hon. Secretary of the Manchester Junior Gas Association, intimates that, at the special request of the members of the Manchester District Institution of Gas Engineers, the joint visit which had been arranged for next Saturday to the Birchenwood coking plant has been postponed to some date in February of which due notice will be given later.

NOTES ON PURIFICATION.

[Communicated.]

The subject of the purification of gas is always a matter of interest to gas managers. Why this should be so is, from one point of view, a surprise, for the process is so inexpensive that it well might be argued that the manager's time would be better employed in the retort-house or on the district rather than in the purifying house. As the "Journal" remarks in an editorial on "Purification Processes" in the issue for Nov. 19 last, "The fact that our pages are now constantly introducing to the notice of readers the subject of the purification of gas shows the large revival of interest there is in this particular line of the work of gas manufacture."

The attention paid to this branch of gas making may be attributed to the natural desire of every man to relieve himself of worry; for nothing causes more anxiety than the feeling that the purifiers may get out of hand. The penalties of supplying gas tainted with sulphuretted hydrogen are in some cases so dire that the responsible man in charge will take endless precautions rather than incur any risk of such an occurrence. No man can ensure against so untoward an event unless he gives time and thought to his purification process. Hence the interest always shown in this side of the gas manager's work.

In this article, the writer proposes to deal in some detail with a few of the methods described in the paper that Mr. C. V. Townsend read before the Yorkshire Junior Gas Association on Nov. 16 last. The subject of purification was well treated, and the paper contained many interesting and practical points, some of which may be profitably discussed at greater length. There is no doubt that in some works to-day a great deal of thought is being given to the best methods of oxide purification; and it is fairly evident that Wakefield is a case in point.

Air Admission.

First of all, the question of air admission, on which the editorial already referred to is somewhat critical. Here, it will be remembered, was described an arrangement whereby small air-blowers are driven off the exhausters, so that however much gas is passed a corresponding quantity of air is drawn into the blowers. At first sight, the arrangement sounds elaborate; and it would be helpful if Mr. Townsend would state the initial cost of installing the blowers, stepped cones, and air pipes, and also give a sketch of the apparatus he describes. Most engineers are satisfied with a cock on the inlet side of the exhauster, with or without an air-meter. Under such circumstances, the admission of air is, of course, constant, and does not vary with the make of gas, provided that the exhauster maintains, as it should do, a constant vacuum. But, as the make of gas does not, or at least should not, vary more than 10 or 15 per cent. from hour to hour, a corresponding variation in the air admission cannot be a very important point. So long as the quantity of air admitted over the twenty-four hours, or per million cubic feet, does not vary appreciably, except by design, the hourly variation is not of material importance. Still, Mr. Townsend's system is an "ideal," and must not be cavilled at. Let us not forget that twenty years ago gas-works managers would have ridiculed the care and precision with which retort-house details are arranged at the present day. Turning dip-pipes to a knife edge is a case in point.

A good method of regulating the supply of air to the purifiers is to collect a sample of clean gas in a small experimental holder throughout the whole twenty-four hours. This gas may then be tested daily for oxygen. Should more than (say) 0·2 per cent. of oxygen be found to be present, the quantity admitted on the inlet of the exhausters may be reduced, and correspondingly increased in the event of no oxygen being observed. By this means, allowance is made for the accidental admission of air while the retort-doors are open; whereas in the case of a regular quantity being admitted, varying in direct proportion to the gas made, no account is taken of such admission.

As to the condition in which the air should be admitted, it is surely unnecessary to introduce moist air even if the oxide is found to become dry in the purifiers, for it must be borne in mind that the gas on leaving the scrubbing plant is saturated with moisture. With an upward travel in the purifiers, most of this condenses at the bottom of the first purifier, and has the effect of temporarily matting the oxide together at this point. This is undoubtedly the main cause of back-pressure being experienced in the first purifiers. So soon as the purifier is changed to the second position, the back-pressure is reduced, for the reason that the gas has now been dried by its passage through the first purifier, and also because the heat generated by the revivification *in situ* has evaporated the moisture. It is thus dispersed, and again absorbed in another part of the purifying plant. But the drying has the effect of opening the pores of the oxide at points where caking has occurred, and thus provides an easier passage for the gas.

This, in the writer's opinion, is the explanation of the fact that in the reverse rotation system a purifier, on being moved from first to second taker, almost invariably shows a decrease in the back-pressure thrown by its contents. The writer has found that coal gas in the outlet of the scrubbers will contain as much as 700 grains of water per 100 cubic feet. It is therefore inadvisable to adopt any method whereby more moisture is added to the gas. Some engineers have made a practice of admitting steam with the

gas at the inlet to the purifiers; but this, in the writer's opinion cannot be of much use, as it is surely unnecessary to add moisture to gas already saturated. When, however, the gas has a downward passage in the purifiers, all the moisture contained therein is condensed in, or upon, the material itself—in fact, with such purifiers the writer has found that the top tier is maintained in too moist a condition, resembling mud rather than oxide. As a consequence, it is necessary to lift the cover from time to time and turn over the top few inches of oxide.

Mechanical Handling of Material.

As Mr. Townsend has pointed out, the mechanical handling of material in purifying-houses is an unwarrantable expense—only in rare cases can it pay. The mechanical appliances should be limited to some form of disintegrator, to break up the lumps, and possibly a simple form of screen. Such apparatus is quite cheap, and would pay for itself, even though purifiers were discharged only six to twelve times a year.

Back-Pressure.

In the paper referred to, the author says "the back-pressure is taken every day, and so any unusual occurrence is noted." Supposing, however, anything does occur, it is not likely to coincide with the actual few minutes that the daily back-pressure figures are being taken. There are many reasons to account for sudden rises of back-pressure; and while with new plant of ample size this is not so likely to happen, it is not at all improbable in works where the plant is of insufficient capacity. The best arrangement to guard against sudden and temporary rises in back-pressure is the use of a pressure recorder in some spot where it will be noted at frequent intervals, such as in an engine-room or valve-room. The writer has often noticed sudden increases of back-pressure to result from an abnormally large make of gas, comparing one hour with another. If a good proportion of retorts are charged during one hour, this may well happen. At the writer's works, the back-pressure figures are noted by the valveman, in a book, every half-hour; such a practice ensures proper attention being given to this matter.

Internal Revivification.

One of the greatest boons of internal revivification is that a purifier before being discharged may be worked until last in the series, by which time it will be practically revivified by the oxygen present in the clean gas. The material will show no signs of firing, and it will be in a much more suitable condition for being discharged than were the purifier shut off after being first taker. This is a very great advantage, and is not only an economy, for heated oxide is a source of expense and loss, but is also much appreciated by the men engaged in the work of discharging. The reverse action process, for this reason alone, well justifies its adoption.

Scrubbing Plant as an Auxiliary.

The writer has for some time paid particular attention to the value of scrubbing plant as an auxiliary to the purifiers, for the purpose of extracting the greatest possible quantity of sulphuretted hydrogen from the gas, not to mention carbonic acid. In his own case, the following figures may be of interest:

Average of Daily Tests for Month of: 1912.	Inlet of Scrubbing Plant.		Outlet of Scrubbing Plant.		Inlet of Scrubbing Plant.		Outlet of Scrubbing Plant.	
	SH_2 per 100 c. ft.	SH_2 in Gas.	SH_2 per 100 c. ft.	SH_2 in Gas.	CO_2 per 100 c. ft.	CO_2 in Gas.	CO_2 per 100 c. ft.	CO_2 in Gas.
	Grains.	Pr. Ct.	Grains.	Pr. Ct.	Grains.	Pr. Ct.	Grains.	Pr. Ct.
April . .	339	0·536	231	0·365	2246	2·7	1797	2·2
May . .	436	0·690	272	0·430	1931	2·3	1552	1·9
June . .	437	0·690	270	0·427	1794	2·2	1552	1·9
July . .	446	0·706	261	0·412	2245	2·7	1960	2·4
Aug. . .	346	0·547	213	0·337	2205	2·7	1470	1·8
Sept. . .	453	0·717	263	0·416	2532	3·1	2124	2·6
Oct. . .	571	0·904	276	0·437	2205	2·7	1794	2·2
Nov. . .	516	0·817	253	0·400	2124	2·6	1715	2·1

Here it is seen that the scrubbing plant extracts nearly as much sulphuretted hydrogen as the purifiers. As a result of this, the cost and trouble of oxide purification are reduced; but at the same time it must be borne in mind that the sulphur extracted in the form of sulphuretted hydrogen by the ammoniacal liquor is irrecoverable so far as the works are concerned. Had it been absorbed by the oxide, it would have been recovered and sold as "sulphur." In the case of the sulphur contained in the liquor, it is again recovered during the manufacture of sulphate of ammonia, so that the chemical works are benefited by this arrangement. In cases where a sulphuric acid plant is worked in conjunction with sulphate manufacture, the sulphuretted hydrogen gases passing from the saturator are mixed with the products of combustion from the oxide burners, and thus become a valuable source of revenue to the acid maker.

This fact should not be overlooked in selling ammoniacal liquor to a chemical works. Some substantial amount should be paid for the sulphur contained in the liquor. Analyses of the liquor should be taken, from which it may be calculated how much acid can be made from the sulphur therein contained. Even should the liquor be worked up into sulphate of ammonia in the same works as that in which it is produced, the purification plant should be credited with the value of the sulphur recovered during the process. It is therefore quite obvious that, even were all the sulphuretted hydrogen extracted from the gas by means of ammoniacal liquor, the increased value of the latter should be recognized, and payments made accordingly. If this can be wholly or even partly effected, the sulphur contained in the liquor should bring in as large a return as, if not a larger one than, it would were it recovered in oxide of iron.

To return to the figures reproduced above, it will be observed that the gas contains comparatively little sulphuretted hydrogen on the outlet of the scrubbers, and the writer believes that the quantity is much less than is usually found at this part of the plant in other works. This is attributed to a practice of bringing the gas into contact with an abundant quantity of ammoniacal liquor in the scrubbers. To do this, it was necessary to instal larger pumps than were previously in use, with the firm intention of soaking the gas at this stage.

In these works, four tower scrubbers and no washers are used. The scrubbers are filled with coke, except in the case of the last one, which is fitted with boards, and which was done for a specific purpose. When filled with coke, much trouble was experienced with back-pressure; and it was no novelty to find this scrubber throwing 12 inches of pressure. This was attributed to naphthalene; and for some time it was made a practice to steam it thoroughly every week. For a few days the back-pressure would be reduced to one-half, when it would again increase. On cleaning out the scrubber, it was found that each piece of coke was covered with about $\frac{1}{4}$-inch of deposit forming an incrustation over its entire surface. Thus the void through which gas and water were expected to pass was as nearly as possible completely blocked. The deposit was caused by the clean water, which, softened by the ammonia present, readily precipitated the sediment upon the rough surface of the coke. A sight of this coke soon explained what had been for a considerable time a complete mystery.

The figures, to which reference has already been made, are not satisfactory so far as the extraction of carbonic acid is concerned. A small proportion only is absorbed from the gas; but this is a secondary consideration nowadays. There is no doubt that, given good scrubbing plant, much sulphuretted hydrogen and carbonic acid may be extracted from the gas. One of the best known firms making washing and scrubbing plant give in their catalogue actual results obtained in this respect at various works. At one works, the tests taken showed that from 50 to 83 per cent. of the sulphuretted hydrogen and from 28 to 57 per cent. of the carbonic acid were removed from the gas in a washer-scrubber. At another works, 62 per cent. of sulphuretted hydrogen and from 55 to 70 per cent. of carbonic acid were extracted by the same means. Yet another showed that from 71 to 100 per cent. of sulphuretted hydrogen and from 62 to 80 per cent. of carbonic acid were removed in the scrubbing plant. In all these cases, the whole of the ammonia was extracted at the same time. In the case of the last mentioned test, an average of only 0·18 per cent. of sulphuretted hydrogen and 0·34 per cent. of carbonic acid remained in the gas after passing through the washer-scrubber. This is an excellent result, and emphasizes the importance of giving a good deal of attention to efficient scrubbing plant.

Work in this direction will assist in bringing to realization the purification of gas by ammoniacal liquor, combined with the use of oxide purifiers as "checks." The difficulties to be overcome will no doubt be surmounted before long; and it is quite probable that this ideal will be realized so soon as some method is discovered of increasing the yield of ammonia in the retort, or, alternatively, of heating retorts by producers working on a system of ammonia recovery. By such means the additional quantity of ammonia would be available for combining with the whole of the sulphuretted hydrogen in the gas.

Vertical Retort Patents.

With reference to the paragraph on this subject published last week, p. 1022, we are informed by Messrs. Woodall and Duckham that the proceedings at the Patent Office were pursued by them because they were of the opinion that the main portion of the subject-matter of the several patent applications in question which were for mere details, had been published by them in the working drawings for settings, which were in course of erection before any of the said applications had been filed. "The result of the proceedings," they add, "merely shows that the Comptroller has no power to take cognizance of prior publications of this kind in considering whether he shall grant a patent." In the paragraph in question, we inadvertently referred to Dempster's continuous retort system as the "Elland" system. As readers will know, the "Elland" system is the same firm's system of intermittent vertical retorts as erected at the Cleethorpes Gas-Works, and as recently ordered for the Singapore Gas-Works. The continuous system of vertical retorts, based on the patents referred to last week, is now in course of erection at the Hebden Bridge Gas-Works.

Mr. Horace Stone Wilcocks, of Chieveley, Mannamead, Plymouth, a Director of the Plymouth and Stonehouse Gas Company, left estate of the value of £68,658.

OBTAINING HOT WATER FROM THE WASTE HEAT OF GAS-OVENS.

Use of Heat-Intercepting Pads.

It has been mentioned in these columns that various workers have been experimenting with the view of putting to serviceable use some of the waste heat from gas-ovens. The direction in which work has been mainly pursued is that of providing a supply of hot water for kitchen use. Devices of this character require tactful application, in order that something may not result that will be less economical than the separate provision of hot water; and it is also necessary that in fitting a water-heating adjunct to a gas-oven its position and material should be such that they will not bring trouble upon the user. There are several matters to be considered. We can imagine, for instance, that some forms of construction might have a prejudicial effect upon the temperature of the oven, and might be the cause of, *plus* the waste heat, a consumption of gas that would produce a positive disadvantage instead of an advantage. However, there is always an amount of heat being wasted from a gas-oven; and how best to utilize this, so as to show an economy on the amount of gas required for cooking and for independently heating a given quantity of water, is the object of the workers in this line.

The Potterton System Described.

During the past twelve months, Mr. Thomas Potterton, of the Cavendish Works, Balham (who is a specialist in the heating of water by gaseous and solid fuel), has, under ordinary working conditions, been using one of his patent "Seal" oven cookers (No. 1 size), fitted for the provision of hot water by intercepting the heat usually wasted, to a greater or less degree, from the casings of gas-cookers. In his system, Mr. Potterton does not use any water-heating arrangement inside the oven. He employs what he terms heat-intercepting water-pads, which are, or can be, fitted externally to the sides, the back, and the top of the oven. In his arrangement, the top, the back, and the door of the "Seal" oven are packed in the usual way, and are ordinarily double cased. [It will be remembered that, unless otherwise stated, we are only dealing here with the "Seal" type of cooker, in which the flames and products of combustion are outside the inner casing.] At the top and the back, the heat-intercepting water-pads are affixed to the outer casing. At the sides there are cast-iron flues in the oven, with an air space between them and the iron casing of the oven. Here the water-heater is fixed tightly on the outside of the inner casing; and in order that there shall be economical action, this is lagged on Potterton's special system. The effectiveness of this lagging in conserving the temperature of the water is shown by, in one test made for the purpose, water being drawn at 150° Fahr. two hours after the gas was extinguished in the oven. Incidentally, it may be mentioned that ventilators are fitted to the oven door to open when roasting. The whole, it is seen, forms a complete equipment for the combined purposes of roasting, baking, and water heating. The most perfect system on which to run the gas-oven water-heaters is to have feed-water cisterns fitted, as then the pads always remain full of water, and 20 quarts or more of hot water can be drawn. In the case of ovens having pads filled by hand, only about 12 quarts of water are available. The lower part of the pads always contains some water—it being impossible to entirely empty them from the draw-off tap.

This is a general description of the developments made in the "Seal" gas-oven, in order to utilize waste heat for heating water. With the water-padded oven many tests have been carried out, in order to ascertain the exact temperature effects with the two operations of roasting or baking and water-heating proceeding simultaneously—using the one source of heat. In examining the tests, it will be well to bear in mind that the stated quantities and temperatures of water are with the oven only working, and not the top-plate. A further point of interest is that the tests have all been made under ordinary working conditions, and the utmost care has been exercised to ensure accuracy. The notes upon, and the results of, the tests, are particularly interesting in view of the novelty attaching to them.

Conditions in the Oven.

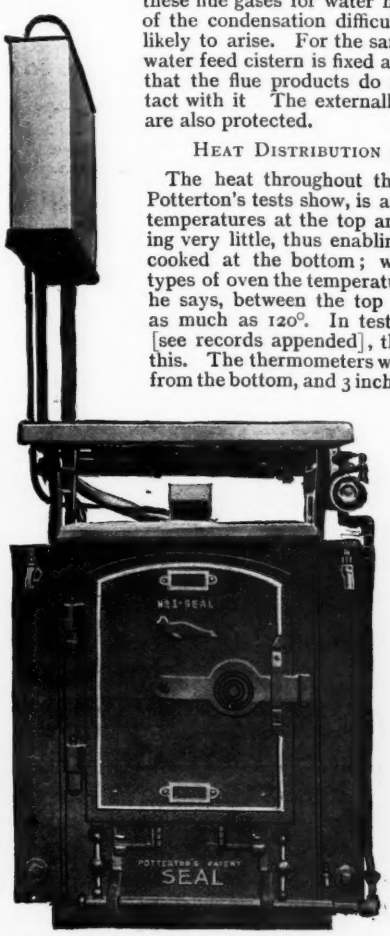
The conditions existing in a small size "Seal" oven (No. 1) when cooking is proceeding has been the subject of investigation by Mr. Potterton; and these are the results that he presents: The oven in question is 14 in. wide by 13 in. deep by 20 in. high. This contains internally 9 square feet of surface receiving heat and conveying it away to waste through the sides, back, &c. A shoulder of mutton would have on the average about 2 feet superficial area exposed to the temperature of the oven, as compared with 9 superficial feet of metal casing forming the enclosure. The larger surface—*i.e.*, the 9 feet—takes its full proportion of heat, part of which is usually carried away and wasted; and it is this heat Mr. Potterton intercepts and utilizes for heating water.

For example, assuming 32 cubic feet of gas were used with a calorific value of 500 B.Th.U. per cubic foot, this represents 16,000 B.Th.U. Of this, assume that 25 per cent. is taken up by the food—that is to say, 4000 B.Th.U.; and that, under ordinary conditions, the balance (75 per cent.) is lost. Now, if 6 gallons of water were raised from 50° to 150°, 6000 B.Th.U. additional heat would be utilized; leaving 6000 B.Th.U. escaping by way of the flue and oven casings not covered with water pads.

Regarding flue temperature, the following results were registered when cooking 6 lbs. of meat, potatoes, batter pudding, and a rice pudding in a No. 1 "Seal" cooker:

		Temp. Inside Oven.		Flue Temperature.
Gas lighted . .	11.10			
,, used 10 ft.	11.30	.. 300° Fahr.	..	200° Fahr.
,, ,, 7½ ,,	11.45	.. 400° ,,	..	240° ,,
,, ,, 7½ ,,	12.0	.. 420° ,,	..	260° ,,
,, ,, 7½ ,,	1.0	.. 435° ,,	..	275° ,,
Total 31½ ft.				

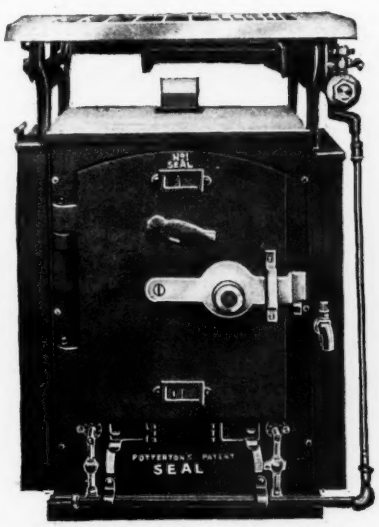
It will, of course, be remembered that the products of combustion do not in the "Seal" cooker come into contact with food, but pass through the cast-iron flues. No attempt is made to utilize these flue gases for water heating, on account of the condensation difficulties that would be likely to arise. For the same reason, the cold water feed cistern is fixed at the side, to ensure that the flue products do not come into contact with it The externally fitted water-pads are also protected.



Gas-Oven Water-Heater with Cold-Feed Cistern.

Heat Distribution in the Oven.

The heat throughout the sealed oven, Mr. Potterton's tests show, is almost uniform—the temperatures at the top and the bottom varying very little, thus enabling food to be quite cooked at the bottom; whereas, with some types of oven the temperature is found to vary, he says, between the top and the bottom by as much as 120°. In tests made on Nov. 20 [see records appended], there is the proof of this. The thermometers were located 3 inches from the bottom, and 3 inches below the crown;



The Hand-Fed Gas-Oven Water-Heater.

while in the case of the ordinary oven (cooking space 11¾ in. by 11¾ in. by 17½ in.), the lower thermometer was placed at the level of the bottom shelf.

Other Details.

With the stoves having separate feed cisterns, taps are fitted to the top of the water-pad on each side; the parts being so connected that the hot water on one side cannot be drawn at the opposite side. The opening of a tap causes cold water to enter the lower part of the pad at the rear; thus allowing the hot water to pass from the upper part of the rear pad into the bottom of a side pad and out at the top. In this way all the hot water of one side and back may be drawn without touching the opposite side, where similar conditions exist. In the case of an oven having water-pads filled by hand, the two sides can be connected by a pipe at the back—thus permitting the supply to be taken from both, or they can be worked separately just as desired.

The tests dated Nov. 30 and Dec. 1 show, in the one case, the working of the stove when heating water without food in the oven; while in the other results are given when using the oven for both cooking and water heating. It should be noted that these are winter tests; and the temperature of the room in which the experiments were carried out registered in some cases as low as 42° Fahr. The tests that have been made date from January of last year, when pads were fitted to a cooker which has been in constant use ever since. Of course, it will be understood that, in Nos. 2 and 3 sizes of the "Seal" oven, pads can be fitted to give a larger supply of water.

Example Tests.

Nov. 24, 1912.

Test of Potterton's No. 1 "Seal" Oven with Water-Way Side, Containing 14 Quarts of Water at 55°.

Food cooked—Forequarter of lamb, 6 lbs.
Batter pudding and potatoes in dripping-pan.
Rice pudding on top grid.

Gas lighted 11.10 a.m. Potatoes put in oven at bottom; rice pudding at top.
10 feet of gas used 11.30 Meat put in, gas turned down to 15 feet per hour.
12.0 Batter pudding put in.
12.45 Rice pudding taken out.
1.0 All food taken out of oven.

Total gas used 31 cub. ft.

Temperature of water 142° Fahr.
50 minutes later (1.50) ,, ,, ,, 152° ,, water drawn for dish washing.

It will be noticed that the water increased in temperature after the gas was turned out; the small air-doors being shut so that no cold air could pass through the flues to carry away the heat, which is taken up by the water.

Nov. 29, 1912.

Test of No. 1 "Seal" Oven, Fitted with Packed Side and Back. No Water Pads; and no Cooking Proceeding.

Experiment: Burn 10 cubic feet of gas in twenty minutes, and take readings. Then shut down to 18 feet per hour, and take readings every fifteen minutes until 32 feet are consumed. Then extinguish, and take four readings at intervals of half an hour each.

Gas pressure, 37-10ths.

Gas Lighted 10 a.m.	Oven Temperature at Top.	Oven Temperature at Bottom.	Gas Consumption. Cubic Feet.
10.21½	290°	300°	10·00
Gas cut down to 18 cubic feet per hour.			
10.36½	395°	405°	4·10
10.51½	445°	445°	4·75
11.6½	468°	465°	4·40
11.21½	495°	485°	4·50
11·36½	510°	490°	4·25
			32·00
Gas turned out.			
12.10	360°	300°	
12.40	250°	190°	
1.10	185°	145°	
1.40	155°	120°	

Test to Ascertain the Amount of Gas Required to Maintain a Cooking Temperature of about 440° Fahr. in "Seal" Oven (from General Observations, it appears that most Cooking is done at this Temperature).

Gas Re-Lighted 1.40.	Oven Temperature at Top.	Oven Temperature at Bottom.	Gas Consumption.
2. 0	370°	365°	11 ft. (gas reduced)
2.15	435°	430°	4 ft.
2.30	455°	440°	18 ft. (total gas reduced.)
2.30 Gas reduced to 9 ft. per hour.			
3. 0	435°	390°	at 9 ft. per hour.
3.30	435°	390°	at 12 ft. ,,
4. 0	435°	395°	,, ,,
4.30	445°	410°	,, ,,
5. 0	450°	415°	
5.30	440°	400°	pressure down 6-10ths.
6. 0	440°	396°	gas turned off.
6.30	320°	265°	
7. 0	260°	205°	
7.30	200°	155°	
8. 0	165°	130°	

Nov. 29, 1912.

Test of Ordinary Gas Cooker. (No Food in Oven.)

Cooking space, 11¾ in. by 11¾ in. by 17½ in.

Gas lighted at 8.50 at 27 cub. ft. per hour.

	Oven Temperature at Top.	Oven Temperature at Bottom.	Gas Consumption.
9.10	570°	355°	9 ft.
Gas reduced to 15 ft. per hour.			
9.40	475°	355°	7½
10.10	500°	380°	7¾
10.44	500°	385°	8½
			Total 32½ ft.

11.14 ½ hour after gas was shut off, the oven registered 240° .. 165°

Nov. 30, 1912.

Test of "Seal" Cooker with Water-Pads at Sides and Back, containing the following Quantities of Water: Back, 5½ Quarts: Each Side, 7 Quarts—Total, 19½ Quarts. (No Food in Oven.)

Temperature of water, 46°. Temperature of room, 46°.

Gas lighted 12.24	Oven Temperature at Top.	Oven Temperature at Bottom.	Gas Consumption.
12.46	300°	275°	10 ft.
[Gas reduced to 15 feet per hour.]			
1.16	400°	365°	7.50
1.46	420°	370°	7.25
2.16	435°	390°	7.25
2.19	32½ ft. gas consumed	Temp. of water left	161°
		,, ,, right	159°
		,, ,, back	150°
2.49	320°	255°	
3.19	230°	180°	Temp. of water, left 168°
		,, ,, right	167°
		,, ,, back	163°
4.19	140°	110°	,, ,, left 155°
		,, ,, right	150°
		,, ,, back	145°

Dec. 1, 1912.

Test Repeated Next Morning, but Cooking (in addition to Water-Heating) 5 lbs. 12 oz. Forequarter Lamb, Batter Pudding and Potatoes under Meat, with Rice Pudding on Top Grill.

Temperature in oven 42°. Temperature of water 55° (the water was left in from the previous day).

Gas lighted 11.0 Meat, with potatoes under, put in cold oven.
11.21 Rice pudding put in. 10 ft. gas reduced to 15 ft. per hour.
12.0 Batter pudding put under meat.
1.0 Gas out. Food taken out of oven all well done.
35 cub. ft. gas consumed.

Temperature of water.	left	149°
,, ,,	right	147°
,, ,,	back	134°
	One Hour Later—	
,, ,,	left	156°
,, ,,	right	155°
,, ,,	back	145°

Dec. 21, 1912.

Test of No. 1 "Seal" Cooker, with Luminous Flames. Galvanized Water Pads containing 8 Quarts of Water Each Side and 6 Quarts in Back. No Cooking.

Gas pressure, 28-10ths. Cast-iron flues to oven.
Temperature of room, 50°. Temperature inside oven at start, 60°.
Gas lighted, 10.10.

Gas.	Time.	Oven Temperature at Top.	Oven Temperature at Bottom.	
10 ft.	10.33	310°	335°	
[Gas cut down to about 15 ft. per hour.]				
	11. 3			
6½	11. 3	395°	385°	
7	11.33	430°	415°	
9 (32½ ft. total)	12. 5	445°	430°	gas out.
	1. 5	280°	210°	

At 1.5 from pad on right-hand side—
Water drawn 2 gallons: 154° to 140°; 142° in pail.
Next 2 gallons from same side: 140° to 110°; 126° in pail.
Left side water drawn 2 gallons: 154° to 130°; 138° in pail.
Next 1 gallon drawn from same side: 120° to 90°; 99° in pail.

The water was drawn into a 2 gallon pail, and then put into a galvanized iron bath. 7 gallons in bulk gave a temperature of 125° Fahr.

Note.—It will be observed that 4 gallons of water were drawn from the right-hand side, being the contents of the right-hand side and back pads. The left-hand pad which was not emptied in the foregoing operation contained 2 gallons of hot water. This was then drawn, and a further gallon afterwards, making 3 gallons in all. There was still some warm water left in the pads, due to the heat of the metal. The left-hand one registered 90° at tap; and the right-hand one 110°, at the end of drawing water.

DEC. 20, 1912.

Test of No. 1 "Seal" Cooker, with Bunsen Flame. Galvanized Iron Water Pads Contained 8 Quarts of Water Each Side and 6 Quarts at Back. No Cooking.

Gas pressure, 30-10ths. Cast-iron flues to oven.
Temperature of room, 50°. Temperature of water, 50°.
Gas lighted, 9.10. Temperature inside oven, 50°.

Gas.	Time.	Oven Temperature at Top.	Oven Temperature at Bottom.
10 ft.	9.30	295°	305°
	[Gas reduced to 15 ft. per hour.]		
8 ,,	10. 0	402°	410°
7½ ,,	10.30	430°	415°
7 ,,	11. 0	440°	425°
	[Gas turned out.]		
30½ ,,			

Temperature of Water in Tanks.

	Right-Hand Pad.	Left-Hand Pad.	
11 a.m.	144°	150°	
12	1 gallon drawn 150° to 144°	1 gallon drawn 151° to 147°	Mean temperature of the 2 gallons, 143°
1 p.m.	2 gallons drawn 128° bulk 116°	2 gallons drawn 124° bulk 116°	

GENERAL OBSERVATIONS.

There are one or two further general observations. Mr. Potterton finds that with No. 1 "Seal" cooker without water pads 12 cubic feet of gas per hour are required in winter to maintain an oven temperature of about 440°. To maintain a temperature with three water-pads fitted to the oven, 15 cubic feet of gas per hour are needed. Therefore by using 6 cubic feet of gas extra (two hours) 19½ quarts of hot water are obtained. To heat this quantity of water to a temperature of 150° Fahr. over a gas-ring, some 20 cubic feet of gas would be consumed. Using a saucepan on a gas-cooker ring, 6 cubic feet of gas were used to raise 6 quarts of water from 57° to 146° Fahr. in ten minutes. Using a kettle (slightly furred inside) 2¾ cubic feet of gas were used to heat 2 quarts of water from 57° to 150° Fahr. in six minutes. With water-pads on the oven top as well as at the sides, 24 quarts of water can be obtained, instead of only 19½ quarts.

POSSIBLE EFFECT OF CERTAIN PHYSICAL AGENCIES ON HEALTH.

Electric Light and Eyesight.

There was read at a recent meeting of the North-Western Branch of the Society of Medical Officers of Health, by Dr. MEREDITH YOUNG, the Medical Officer of Health of the County of Cheshire, a lengthy paper entitled "A Consideration of the Possible Effect of Certain Physical Agencies of Health." The paper is published in full in the current number of "Public Health" (the organ of the Society); and from it extracts have been taken. For some time, it may be pointed out, Dr. Young has been giving consideration to the matter of how far our advancing civilization is having an effect on health—particularly on the health and well-being of our special organs of sight, hearing, and smell, and through these on our nervous mechanism as a whole; and in the first part of his paper he deals with the physical agency of heat. The author then proceeds to make the following remarks on artificial light.

With the advancement of modern science, we have been brought under very trying conditions in the matter of artificial light; and it is distinctly questionable whether our eyes have been educated up to such a point that they can face most of these new lights unless very careful shading and screening be adopted.

The manufacturers of modern electric lighting accessories have fully realized the physical fact that their greatest success will be attained when they have got the fullest possible amount of the energy of the current available concentrated at work in the visible part of the spectrum. By way of explanation, one may say that the energy, in the visible part of the spectrum, of a gas-flame is practically *nil*, and, despite the fact that the temperature of the arc lamp is the highest obtainable, only comparatively little of the energy is manifested in the visible part of its spectrum.

The old carbon filament lamps could only be raised to a temperature very much below that of the present metallic filament lamps; but the latter again fall considerably below the temperature attainable in the arc lamp. Manufacturers of eleetric light lamps are now endeavouring, by the utilization of materials which will stand a very high temperature, and in other ways, to secure that the available energy shall be concentrated as much as possible in the visible part of the spectrum, in order to obtain as brilliant a light as the current employed can possibly yield. Developments towards the maximum are undoubtedly taking place very rapidly. Let us hope that they will not come upon us before evolution has properly adapted us to their reception. The metallic filament lamps which have come so rapidly into vogue—tantalum, tungsten, helion or carbon-silicon, and osmium—are no doubt excellent from the point of view of lighting and current consumption; but we know virtually nothing of the possible effects of the light rays from such lamps when unwisely or improperly used. The fairy greenness of the Bastian or Cooper-Hewitt lamp, which shines by the incandescence of mercury vapour, and the golden rays of the "flaming arc" lamp, are, indeed, things of beauty; but, again, there may be dangers attending their use at close quarters, of which we are not aware.

Consider in this connection the effect of concentrated sunlight on the eye. In the case of one famous astronomer, the effect of the cracking of a smoked glass through which he was observing an eclipse resulted in paralysis of the optic nerve. Consider, also, as an instance of the same thing, one which may be well known to some of you—the effect on the eyes of electric welding, where the light produced is so intense that the naked eye cannot bear to look on it, even for an instant; and yet the workers, protected to some extent by smoked or blue glasses, have to concentrate their view continuously first upon one point and then upon another, so as to direct the current to the proper spot. The intensity of the light has been estimated at 8000-candle power; and the heat may rise to 7000° Fahr. [Thorpe, "Diseases of Occupation," p. 354.] The effects are seen not merely in the conjunctiva and cornea [Snell], but also in the optic disc and retina [Thorpe]. That similar, though, of course, less injurious, effects may arise from the use of domestic electric light—particularly in these days when there seems to be a craze for 100 and 50 candle power lamps, several of which may be united in series so as to produce 200 or 300 candle power in one small room—is only to be expected. "Electrical Ophthalmia," or some close equivalent, will shortly be scheduled, not merely as an occupational disease, but as one which may, unless due regard be paid to the effects of glare, have to be reckoned as one of the ordinary penalties of civilization.

I may also tell you this as a concrete illustration of possibilities in this connection—that out of about four electrical engineers connected with municipal electric lighting schemes whom I know personally, two are suffering from a kind of fibrillary tremor of the palpebral muscles, coupled with obvious photophobia, which may terminate in nystagmus. Glass-blowers' cataract seems to come into much the same category of diseases as those to which I have alluded; and exposure to strong electric light has been noted as causing erythema of the skin.

Those of us who are using electric light habitually, know by experience, I fancy, that the effects of its glare are apt to be most irritating. Why is this? Is it because we have to concentrate our vision on a part which is adequately illuminated, and divert it from a part which is inadequately or too brilliantly illuminated, and that the effort becomes exhausting after a short while? Or is it a mere tiring effect, due to the impaction of energy on a part of the retina which, having no work to do, wants to remain quiescent for the time being? Or is it a more direct effect on the retina or optic disc due to over-stimulation or irritation caused by the high-power rays of this light? I am inclined somewhat strongly to the last-named view, for I imagine that education and adaptation of the eye would at this stage of our evolution render the first two factors of comparative unimportance.

Whichever it be, I think our warning should go out to all who use the electric light, whether in the factory or the workshop, the office or the home, that the greatest care should be taken to secure the concentration of an ample but not superabundant light (because of undue reflection) on the work which is being illuminated, without glare, leakages, or undue diffusion, which may result in retinal strain. The speeding-up of machinery in factories is closely connected with this part of my subject It undoubtedly throws a serious strain first of all on the eye, which has to follow at an abnormal rate such things as broken threads; and this subsequently has its effect on the nervous and circulatory systems in particular, inducing premature old age in those who are compelled to adhere to the occupation.

In a part of the paper dealing with the ultra-violet rays, the author remarked: You are all acquainted with their destructive effects on the lower forms of life, as evidenced by the fact that they are now fairly extensively used on the Continent for the sterilization of water. There is an abundant supply of ultra-violet rays in the light furnished by an arc-lamp. He then turned his attention to the results of over-stimulation caused by physical agencies, saying: After exposure to an electrical shock, it is, one is informed, quite common for "nervousness," with headaches and ill-defined pains in various parts of the body, to ensue for some time afterwards; and the peculiar thing is that such conditions appear to be aggravated by disturbed electrical conditions of the atmosphere. This is akin to the feeling which a good many people have when the atmosphere is in a state of electrical tension, as it is prior to a thunderstorm. As is commonly known, many persons feel depressed and "headachey," and suffer from various forms of *malaise* at such a time; and these disagreeable feelings disappear when the electrical tension is removed, or, as they put it, when the air is cleared as a consequence of the storm.

The ground-water plane in the vicinity of one of the pumping-stations at Los Angeles (Cal.) dropped from 6 to 9 feet during the year ended July last, according to the report of the Chief Engineer of the Board of Public Service Commissioners. The precipitation during the period named does not explain this drop, which is attributed largely to the increased extraction of water for agricultural purposes on the coastal plane to the south.

YORKSHIRE JUNIOR GAS ASSOCIATION.

An exceptionally large attendance last Saturday amply justified the Council of this Association in arranging for a meeting of an altogether novel character. It took the form of a visit to the establishment of Messrs. Nicholson and West, Limited, at Northgate, Halifax. This firm is widely known not only in gas circles, but in connection with water-works, mills, collieries, iron-works, &c., to all of which it is an old-established supply centre for all kinds of tools, fittings, and pipes. Originally the visit had been planned for the special benefit of members interested in gas distribution; but as the arrangements were being developed it became obvious that the interest and appeal of the exhibits would concern the whole body of the members. This view was substantiated by the very large representative attendance, and by the keen and persistent interest shown in the articles on view.

The visitors were conducted round in small parties—a numerous staff being in attendance; and the whole of the arrangements were so well planned that, without hurry or confusion, without parties overlapping or members missing any part of the exhibits, a full afternoon of unbroken interest was ensured. The plans adopted for storing the goods rendered inspection easy; but, in addition to this, many specially arranged exhibits were set out, so as to show easily and readily the wide range of types and patterns stocked. In the glass-covered delivery yard, one of each of the types—some twenty in number—of all the coke-barrows stocked was shown. On special tables tools were arranged; and in most cases complete ranges of all the sizes and patterns were shown. On a length of 4-inch pipes were examples of all the types of the firm's drilling apparatus and jointing specialities fixed in position for use.

As the afternoon wore on, surprise was constantly being expressed at the exceptionally large stock held and its wide range; so that though the name of the firm was quite familiar to practically every one present, most had had no idea of the magnitude of the business. No less than 7000 shovels and 3000 coke-forks were seen, so compactly arranged that the number stated seemed incredible until a row or two were counted. Great piles of tubes, tiers of bunkers of nuts and bolts, a large room close-stored with all sizes and varieties of steam fittings, rooms devoted solely to lifting tackle, another to hammers and trowels, stacks of coke-rakes, augers of all patterns, revealed themselves as room after room of the various warehouses was entered.

Among the exhibits to which special attention was drawn were:—Service cleansers for small or large volumes of air, also for use with a solvent which is discharged in a fine cloud of spray through an atomizer. Syphon pumps made of copper and aluminium—fitted with suction hose and strainer. Foot inflators for gas-bags, with pressure gauge attached, so that once having found the pressure needed fully to distend the bag, this may not be exceeded in actual use to the detriment of the bag. Adjustable pillar pipe-vice, which can be attached to any convenient gas-lamp, telegraph-pole, &c. Wall drills and wood plugs, chiefly for internal fittings, on the crown cutter principle with groove for clearance. Short head ratchet-brace and drill for use in confined spaces—2½ inches over all; also others with short stroke for use in confined spaces. Tubular shear-legs with rope pulley—on the larger sizes provided with shackle for raising the pulley-blocks. An automatic tipping coke-barrow, in which the body tips over separately from the wheels and axle, so that the operator is away from the steam and heat. Patent elastic asbestos jointing clips of all sizes. These are designed to supersede clay in running lead joints. A bevel on the inside leaves sufficient lead outside the socket to make a full joint when caulked. Caulking tools for large mains, allowing easy access to the underside. Various cutters for cast-iron and lead pipes. A universal portable drilling-machine with expansion arm, enabling drilling to be done in any position and at any angle. A hydraulic jack for pulling pipes apart.

No good purpose can be served by detailing all that was exposed to view; only it may be added that, to avoid any chance of points of interest being forgotten, the visitors had been informed on the notices calling the meeting that they were at liberty to ask for the exhibition of any other things in which they were interested. Though Government and Colonial officials, and also railway, gas, and water officials, are frequently going through the warehouses, this was the first occasion on which they had been inspected by any association or deputation.

At the close of the inspection, the members were entertained by the firm at tea in the Masonic Hall. Mr. Nicholson occupied the chair, and Mr. West and various members and officials were present; also Mr. M'Lusky, the Gas Engineer to the Halifax Corporation, and a few other visitors.

The CHAIRMAN, in proposing the toast of "The Yorkshire Junior Gas Association," assured the visitors of the heartiness of their welcome and his cordial wishes for the continuous well-being and prosperity of the organization. In relating some of his memories of the gas industry and the advent of its electrical competitor, he expressed the opinion that this opposition and competition had reacted for good in many ways on gas progress.

Mr. W. W. ATLEY, the President, suitably responded.

The thanks of all present to their hosts were expressed by Mr. J. H. HILL and Mr. W. CRANFIELD.

Mr. M'LUSKY, in supporting these remarks, said he had known the firm for some thirty years, and all the corporations under whom he had served had been good customers and had pleasant memories of their transactions. The many thousands of accounts opened with the firm showed that their business had spread far beyond the limits of the gas industry. The outstanding feature of their reputation was the reliance that might be felt in their ability to supply anything needed in times of emergency. Did time permit, he might offer some remarks on the subject already broached—viz., the competition between gas and electricity. He would, however, merely say that his experience of the Yorkshire people had been that they were ready to adopt anything that showed promise of advantage to their business. They were less swayed by prejudice than people in some other districts, and more open to conviction on business matters. While they had a proper appreciation of electricity, they also appreciated gas; and the men of the gas industry would be wise in their day and generation if they did not depreciate the value of electricity. If they wished to develop their gas interests, they must know electricity, and thus be able to meet its competition, not by merely belittling it or running it down. It must be owned that it had a large legitimate field where it had greater advantages. It had a large field in the supply of power; though here gas was displacing solid fuel, while it was also showing its superiority for the lighting of shop-fronts and factories. In Halifax they began last autumn to supply high-pressure gas on a small scale. They were surprised at the way in which it was taken up; and already some 150 lamps had been installed in the centre of the town. Those present had already been able to see, in coming up to the building in which they were assembled, that the most attractive shop-fronts were those which were thus lighted.

Mr. NICHOLSON, in responding, paid a warm tribute to his partner, Mr. H. West (who also briefly responded), on whom, he said, the chief burden of the business now rested. The business had gradually but surely increased during the last forty years, so that its present position was no mushroom growth. They were careful not to have any old stock. They took a pride in keeping just what people wanted, and only this; and they very particularly maintained methodical arrangement and orderly working.

Mr. FELL and Mr. LEE thanked the staff who acted as guides, &c.; and Mr. SHUCKSMITH, the Secretary of the Company, replied.

In most of the speeches warm tributes were paid to the wonderful system and organization shown in the warehouses (equally reflected in the office arrangements); this being one of the permanent values of the visit.

New Year's Honours.—Among the New Year Honours conferred by His Majesty the King, we notice a baronetcy for Sir Frank Crisp, senior partner in the firm of Messrs. Ashurst, Morris, Crisp, and Co., who are the Solicitors to the Monte Video Gas Company; and a knighthood for Lieut.-Colonel Yorke, C.B., who has since 1900 been Chief Inspector of Railways under the Board of Trade, and whose report on the Ditton Junction railway disaster in September was dealt with last week.

Professor Lewes on Liquid Fuel.—The first of the three Cantor Lectures on this subject arranged to be given by Professor Vivian B. Lewes, F.I.C., F.C.S., before the Royal Society of Arts will be delivered on the 20th inst., and the others on the two succeeding Mondays. The lecturer will open his subject by indicating the liquid fuels which are available, then deal with petroleum and its composition—explaining the theories which have been brought forward to account for its formation—and close with some remarks on the composition and distribution of oil.

Disposal of Coal Tar in France.—According to a United States consular report, all the gas companies in the vicinity of Lyons sell large quantities of coal tar to establishments engaged in destructive distillation. There is only one factory producing creosote oils in the Lyons consular district, and a few other factories are found in Bordeaux, Bayonne, Lens, and Paris. Coal tar is usually transported in France in tank-cars and tank-vessels or in kerosene barrels. Tar shipped in casks in the summer months ferments and leaks out easily; in winter, on the contrary, it coagulates—thus rendering the emptying of the casks particularly difficult. In this condition it becomes necessary to warm the receptacles with steam by a method especially contrived for the purpose.

Another Co-Partnership Publication.—An addition has been made to the publications of co-partnership gas companies by the production of the "Croydon Co-Partner" by the Co-Partnership Committee of the Croydon Gas Company. It is the outcome of a meeting of the Committee at which the suggestion of starting a magazine was brought forward and submitted to the Directors, who sanctioned the expenditure involved in the present issue, at the nominal charge of 1d. The number contains a prefatory note on co-partnership by the Chairman (Mr. Charles Hussey, J.P.), of whom an excellent portrait is given as a plate. The contents, which are varied and interesting, include an expression of gratification at the knighthood conferred upon Mr. Corbet Woodall, D.Sc., M.Inst.C.E., who is a Director of the Company. The Editor of the magazine is Mr. W. H. Topley. Its main object, as set forth in the "Editorial Notes," is twofold—"first, to provide a medium by means of which the Company's co-partnership scheme shall be thoroughly understood by everyone concerned; second, to interest the co-partner employees in the work of the undertaking by which they are employed, and so stimulate that generous spirit of corporate pride, without which no scheme of co-partnership can fully realize the hopes of its originators and advocates." The establishment of the magazine upon a permanent basis—say a quarterly periodical—will require the further sanction of the directorate; and this will, no doubt, largely depend upon the reception accorded to the first number by the co-partners as a whole.

TEMPORARY STOPPAGE.

[COMMUNICATED.]

THE question of temporary stoppage must necessarily be one of interest to all gas engineers; for, now-a-days, there are probably few works which are unable to continue their supply without Sunday gas-making, or which have insufficient storage capacity to carry them over the week-ends.

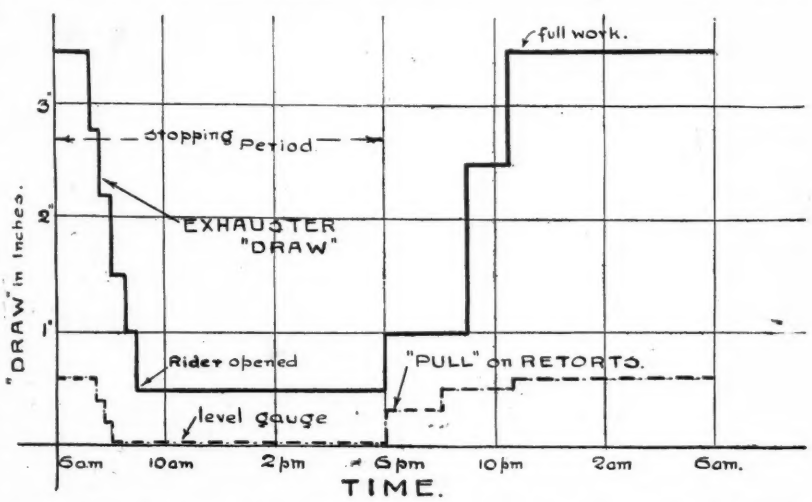
Although the operations of discontinuing the make of gas and recommencing it are usually carried on with little or no difficulty, and are seldom attended with any undesirable results, they are, as a matter of fact, not so simple as might at first sight be supposed, and it is necessary to take a good deal of care in order to ensure smooth and consistent working. Conditions have been somewhat altered of late, owing to the fact that the modern idea of carbonization is to work heavy charges of eight and twelve hours' duration; whereas until recently there was an almost universal preference for the lighter six-hour charge. From the point of view of Sunday stopping, the larger and heavier charge is certainly to be preferred.

A great objection to any stoppage is that the continuity of the working is broken, with the result that the quality of the gas is affected, and it is difficult to keep the illuminating and calorific power perfectly uniform. London companies have also to bear in mind the London County Council, who, since they proved their right to Sunday testing some eight years ago, keep a fairly vigilant eye upon the quality of the gas, and prevent the possibility of an indifferent product being supplied to the consumers. The Sunday returns from testing-stations, however, speak well for the shutting-down methods employed; the average candle power tests for this day being seldom, if ever, below the returns received for week-days. Thus consumers have no cause to worry themselves by supposing that on the first day of the week they are paying the same price for an inferior article.

AN EFFECTIVE METHOD.

The general practice is to stop on Sunday for a period of twelve hours—that is from 6 a.m. until 6 p.m., or in some cases the start is deferred to 10 p.m. In this way, Sunday labour in the retort-house is practically done away with; and those companies who make a practice of allowing double pay for this day are enabled to effect a fairly considerable saving. There are many ideas as to the most effectual method of stopping and restarting; and the means employed must to a certain extent depend upon the conditions prevailing at the works—such as the amount of storage-room available, and whether or not there is a water-gas plant.

Below is described a method which will be found to be satisfactory from most points of view, and which has the additional advantage of being extremely simple. Though it is applicable to all cases, whatever the period of stopping, it will be assumed, for the sake of illustration, that it is required to shut down at 6 a.m. on a Sunday morning and to recommence at 6 p.m. the same day. The last retort is charged just before 6 a.m., and for some little time the full volume of gas is being driven off. The diagram is of a vacuum chart showing the pull at the exhauster for the twenty-four hours commencing at 6 a.m. On the same diagram is shown the pull on the hydraulic main for the corresponding period. The whole method of working can be easily grasped by referring to this diagram.



REGULATION OF THE DRAW.

From 6 a.m. to 7.30 a.m., the amount of gas coming away permits the use of the full draw. After this period, the gas evolved gradually becomes less and less, and the draw at the exhauster is reduced by degrees until at 9 a.m. it is regulated to about half an inch. This means that the exhauster must work at its slowest possible speed, and the "rider" is opened slightly so as to give the engine sufficient load and to preserve a steady pull. It will be seen from the retort-house curve that at 8 a.m. the draw is reduced so as to give level-gauge at the hydraulic-main; and this continues until 6 p.m. in the evening, when the retorts are again charged. In the same way the ½-inch draw is maintained at the exhausters until shortly after 6 p.m., when it is gradually raised to the usual amount. The pull on the retorts is, of course, regulated by working the exhauster in conjunction with the retort-house governor. Thus, it can be seen that there is no actual cessation of gas-making and there is no need to blow away any gas. In order that this may be the case, however, the charges must necessarily be heavy and similar to those which are generally adopted in the twelve-hour systems. The make of gas, of course, gradually diminishes each hour until, during the last hour before restarting, it has sunk to about 10 per cent. of the normal figure.

BLOWING-AWAY POOR GAS.

With regard to the regulation of the draw as shown on the diagram, no hard-and-fast rule can be laid down, and everything depends on the quality of the gas which is being obtained. After the last charge of coal has been put in, the candle power should be carefully watched; and when this is noticed to be dropping, the draw on the retorts must be reduced accordingly. On some occasions, such as when an inferior coal is being used, it will not be found possible to continue the work throughout the twelve hours; and when the candle power falls to any extent, it is advisable to stop the exhauster and blow-away the poor gas. This may be done as follows: The main valve at the outlet of the condensers is shut, and the exhauster man—who is standing by ready—immediately notices the change on his chart. He then shuts down the exhauster, and closes the rider. The doubtful gas which is now being evolved is allowed to escape; and for this purpose a four-inch pipe is provided at the inlet to the condensers. This escape pipe dips into a seal-pot and is sealed to a depth of about half an inch. At first, the gas will bubble through the seal fairly freely. But as the amount diminishes, care is necessary; for, when all the gas has been evolved, that remaining in the apparatus will cool and form a vacuum, with the result that air will be sucked in at the blow-off-pipe. To prevent the possibility of this occurring, the seal is deepened until a pressure of about one inch is thrown upon the apparatus.

PREVENTION OF A VACUUM.

The prevention of the formation of this vacuum is probably one of the most important points connected with shutting-down; for serious results might be followed by any intake of air and the consequent formation of an explosive mixture within the apparatus. Probably it will be remembered that Mr. J. Tysoe, in his Presidential Address to the Southern District Association of Gas Engineers in 1903, described how the formation of a vacuum was prevented by running back a small service-pipe from the washers to the apparatus between the exhausters and the hydraulic main. The amount of gas passing through this pipe was quite sufficient to maintain the necessary small pressure, which was prevented from rising above 2 inches by means of a safety seal. Some engineers adopt a method of slackening the levers of the retort-lids and permit the surplus gas to blow out this way. But in the method above described the lids are kept sealed and the gas is expelled into the open air. The great disadvantage of slackening the retort-lids is that the gas is blown off directly into the retort house itself.

With regard to the diagram, it should be pointed out that the actual charts taken from the gauges have not been reproduced, owing to the fact that each curve would then be on a different chart. The writer thinks that the working is indicated far better by combining the curves on one diagram.

REGULATING THE FURNACES.

When making a temporary stop, the retort charging is, of course, discontinued during the period and, therefore, a point which must not be overlooked is the regulation of the heat in the settings. The last charge put into each retort is allowed to "stew" during the whole stopping period, and thus a considerable amount of heat may be dispensed with, with a consequent reduction in fuel used. Generally the main dampers on the setting may be closed to about one-half of their normal amount, and they are left in this position until 3 p.m., when they should be opened to the usual amount, in order to get up the heats for the evening charges. The primary and secondary air-slides should also be closed—both to about one half the usual working amount. If the dampers and slides are regulated in this way, it will be found unnecessary to put coke into the furnaces for the whole period of twelve hours—that is, unless the latter are of a very small type.

DIFFUSION IN HOLDERS.

In connection with temporary stopping, the question of the diffusion of gas in the holders is of extreme importance. It is generally taken for granted that, should any inferior gas get for-

ward to the holder, it will thoroughly mix with the better quality gas already therein, with the result that the average quality is quite up to the normal. In some cases, however, there appears to be doubt as to whether complete diffusion does actually take place and, in holders in which the inlet and outlet pipes are side by side, it would appear that the gas (or part of it at any rate) travels at times from one pipe to the other without any admixture at all with that already in the holder. As a matter of fact, the writer has heard of cases of extremely large holders in which the same thing appears to have taken place, even when the inlet and outlet pipes are on opposite sides of the tank. It has been suggested that the warm incoming gas travels directly to the top of the holder, and sets up a current which brings it down almost immediately on the other side.

As regards a water-gas plant, there is no doubt that it is an exceedingly useful adjunct in connection with the week-end stoppage, and with its aid the candle power of the gas can be regulated and improved when necessary. In cases of emergency, such as a sudden fog during the stopping period, some works might be placed in an awkward position should they find the demand suddenly increasing heavily after their retort-house hands had been dismissed for the day. In most cases the storage would be ample to cope with such demands; but if this was not the case, the utility of a water-gas plant is self-evident.

VERTICAL RETORTS AT BURNLEY.

In accordance with the wishes of the Town Council, Mr. J. P. Leather, the Gas Engineer and Manager to the Burnley Corporation, has prepared the following report on the vertical retorts installed some time ago at the gas-works there.

Reports as to the expenditure on, and the working of, the vertical retorts at the gas-works have been previously made. The present report is an endeavour to summarize and supplement these in accordance with the resolution of the Council on Oct. 30 last.

After a consideration extending over nearly two years, including reports on the working of various systems of carbonizing at Bournemouth, London, and Berlin, the Gas Committee, on Nov. 19, 1908, decided to install nine settings of vertical retorts in accordance with the Woodall-Duckham patents. The contract price for the installation was £10,800. This contract did not include the building of the retort-house and coal-store or the coal-handling plant; and it may be well here to repeat the figures given after the completion of the work, in a report presented to the Committee in December, 1910. It must be remembered that these figures include the retort-house and coal-store and coal-handling machinery for further prospective extensions.

Retort-house and coal-store	£7,163 9 10
Coal-handling plant	2,231 10 0
Vertical retort bench	10,961 5 3
	£20,356 5 1

The additional sum for vertical retorts of £161 5s. 3d. over and above the contract with Woodall and Duckham was for motive power, gearing, and shafting external to the retort-bench, which were not included in the contract.

The contractors agreed in their contract that: (1) Each retort should be capable of carbonizing 52 cwt. of coal per 24 hours; (2) the amount of gas from each ton of coal carbonized should not be less than 12,000 cubic feet; and (3) the sperm value obtained in gas from each ton should not be less than that obtained from similar coal in the inclined retorts.

The first gas was made in the new installation on Feb. 2, 1910; and the whole of the retorts were in operation by March 19. The contract provided for supervision by the contractors during the first eight weeks' working. Owing, however, to difficulties which were encountered, this period was extended to eight months. During this time, the contractors made a number of alterations tending to better working, at considerable expense to themselves. To understand the "difficulties" referred to, it is necessary to enter briefly into the principles and method of carbonizing coal.

In all previous systems which have been successfully worked on a large scale, it has been the practice to place quickly in an open retort a quantity of cold coal. The lid of the retort being closed, the coal is acted on by the heat from the furnace surrounding the retort. A process known as destructive distillation takes place, which consists in the breaking-up of the complex organic substances in the coal, whereby gases and vapours are driven off, and leave the retort by the pipe provided for the purpose. There remains in the retort solid carbon (containing the inorganic impurities of the coal), in the form known as coke. On the retort being opened, the coke is withdrawn from the retort.

From this description, it would appear that no difficulty should arise in a retort placed vertically, as the coal would enter and the coke leave by gravitation. There is, however, an intermediate condition of the coal to be considered. Before the coal reaches its full carbonizing temperature (say 1400° Fahr.), it passes through a tarry, pasty condition, in which it tends to cling to the sides of the retort. Further, it swells considerably in bulk; and though with a further increase of temperature it shrinks slightly, there is a possibility of its bridging across the retort and wedging itself fast. If this happens in the Woodall-Duckham system, in which the coke is being continuously withdrawn from the bottom, a free space is formed in the retort which subsequently gets too hot if the bridging of the coal is not broken down in good time.

The disadvantages of this bridging, from both a mechanical and a chemical point of view, are too complicated for full consideration in a report of this nature; but two points may be readily understood without much technical or chemical knowledge. First, that the movement of the charge in the retort should be continuous; and, secondly, that the fact of a cessation of the movement should be evident to the man in charge before any serious disadvantages have accrued. The first of these requirements was not fully realized at the commencement, in consequence of imperfections in the mechanical arrangements for driving the extractors at the bottom of the retorts; and it was this which necessitated the alterations I have already referred to, and the prolongation of the period of supervision by the contractors. The second point is largely a question of experience on the part of the men. Unfortunately, the frequency of stoppages in the first few months of working necessitated the frequent breaking down of the bridging by a rod inserted into the retort through a hole provided for the purpose. This resulted in a habit of "rodding" even when it was not necessary. This "rodding" not always being done intelligently (as the men cannot see what is happening in the retort), caused in many cases serious damage to the retorts; the rods being pushed against the side of the retort.

A new method of introducing the coal into the retort has been devised, which is adopted in all recent installations. Instead of the coal entering the retort in small quantities through a mechanically-driven device, a coal-box is provided over the top of the retort which is filled at intervals by the man in charge, and gravitates gradually into the retort. In our case, the distance between the retort and the overhead hoppers only allows of a small box, which has to be replenished every half-hour. In most recent installations, the box is arranged to hold three hours' supply. Before the introduction of this new method (the cost of which I refer to below), we did not succeed in training the men to discover promptly when a stoppage had taken place in any retort. The consequence was that frequently a large space in a retort would be empty of coal. This not only meant loss in working, but serious damage to the retorts by over-heating, in addition to that which I have already stated was caused by excessive and non-intelligent "rodding."

Although I was able to report in December, 1910, that the conditions of the contract had been complied with, inasmuch as we had proved the retorts to be capable of dealing with the guaranteed quantity of coal and producing at least 12,000 cubic feet of gas per ton, the condition of the retorts became worse from the causes referred to; and though portions of six retorts had already been repaired at a cost of £21 8s. 6d., it became evident in May, 1911, that a more drastic remedy was required, and I reported to the Committee that it was advisable to renew a number of the retorts. For this purpose, it was necessary to cease working the installation and make a thorough examination of the retorts and brickwork. The Committee instructed me to make such repairs as were necessary. As the repairs progressed, it was found desirable to renew a larger portion of the work than was at first expected. Eventually, 24 of the retorts were entirely renewed and reset with a different arrangement of flues from that originally adopted. The cost of these extensive repairs—which, of course, did not affect the main structure or the mechanical arrangements for the discharge, &c., of the retorts—amounted to £542 13s.

When this work was done, I arranged to alter the mouthpieces at the top of the retorts, providing coal-boxes capable of holding sufficient coal to supply the retorts for nearly half-an-hour, in the manner referred to above. The cost of this alteration was £207 15s. 6d. When these repairs and alterations were complete, the fires were again lighted, and the first two beds of retorts were put in operation in April, 1912. The results of the alterations were at once seen in improved conditions of working; the coal passing through with very little attention. The consumption of gas during the summer has increased very considerably during the last few years; and it was not possible to stop the other retorts working, so as to obtain a measurement of the gas from the verticals alone. For a short time in July, the inclined retorts were put out of action, and the quantity of gas required was made up by carburetted water gas. It was then found that the illuminating power of the gas was much above the average, though the quantity during the fortnight when figures were available only averaged 11,368 cubic feet per ton. On the few days when carburetted gas was not made (during the Fair Holidays), the illuminating power rose to 18·60 candles from coal only.

The increased gas consumption early in the month of October necessitated five charges per day being put into some of the inclined retorts. These extra charges were continued a little too long, as the consumption did not quite come up to expectation; so that though they were put down to four charges again on the 10th, the holders were too full on the 11th. To avoid blowing away gas, the verticals were entirely stopped for some hours. The make at once dropped from 103,500 cubic feet per hour to 65,250 cubic feet per hour—some hours the make being as low as 63,000 cubic feet. This shows that the vertical retorts were making at the rate of

918,000 cubic feet per day. As they were not using more than 75 tons per day, this corresponds to a make of 12,240 cubic feet per ton. Our tests show that the illuminating power from the vertical retorts is higher than from the inclines. Reduced to the same standard of illuminating power, the make would considerably exceed the 12,600 cubic feet per ton.

When recommending the adoption of this system of carbonizing in my report to the Committee in November, 1908, I divided the advantages anticipated under nine heads, as follows.

1.—I stated "we may expect to obtain the equivalent of an increase of 10 per cent. on our present make per ton." The make per ton in 1908-9 was 10,380 cubic feet. Last year the average on the whole works was 11,249 cubic feet, and we have made at times in the vertical retorts 12,600 cubic feet per ton. This advantage has therefore been fully realized.

2.—*Improved Quality of Tar.*—Our analyses show a smaller percentage of "free carbon"—4 per cent., as compared with the usual 7 per cent.—while the quantity is certainly not smaller.

3.—*Increased Yield of Ammonia.*—The reports of the vertical retorts in Germany, and some theoretical considerations, led me to expect as much as 25 per cent. increase. We are unable to separate the ammonia obtained from that produced in other retorts; but the total production of sulphate of ammonia during the two years in which vertical retorts have been working has been 25·33 lbs. and 25·38 lbs. respectively. The average of the preceding five years was 24·61 lbs. Considering the proportion of coal carbonized in the verticals, this points to a definite increase, though not so much as 25 per cent.

4.—*Improved Quality of Coke.*—This is undoubted; the percentage of moisture being much less. In some works, higher prices are charged for coke from vertical retorts as compared with other coke on the same works.

5.—*Absence of Trouble from Stopped Pipes and Pitch.*—The non-realization of this was at first one of my greatest disappointments; but the improvement this season compared with last leads me to hope that it will be eventually realized. The trouble, however, leads to less expenditure than in the inclines.

6.—*Increased Make of Gas per Retort and in Proportion to Ground Space.*—In our inclined retort-house, where the benches are much too closely packed for comfortable working, the maximum make is about 180 cubic feet per square foot of retort-house. The new retort-house was planned and built before it was decided to erect vertical retorts, and is consequently wider than was required; but notwithstanding the unnecessary space, the make works out 187 cubic feet per square foot of ground space. The make per retort is 30,000 cubic feet, as compared with 13,000 cubic feet in the inclines.

7.—*Better Conditions for Workmen.*—The absence of red-hot coke, and the heat therefrom ensure this.

8.—*Reduction in Heavy Labour.*—This is self-evident.

9.—*Reduced Cost of Maintenance.*—I anticpate much longer life for these retorts; but longer experience is required to prove this.

As pioneers, we have had difficulties; but if there were no pioneers, there would be no progress. On the other hand, we have had advantages. Before the contract was entered into or the price fixed, I went very minutely into the quantities and prices on which the contractors based their estimates; their figures being fully disclosed to me. The result was a price for the whole working out at under £120 per ton of coal per day capacity. Contracts made this year, prior to the recent advances in iron and other materials, have been made at the rate of £130 per ton or over; so that even allowing for the expenditure of which I have given figures above, we have gained by adopting the system when we did.

I cannot conclude without expressing the feeling that those who have criticized have not realized the difficulties inherent in a new departure of this kind. When 32 years ago the first settings to be charged by machinery were erected in the retort-house now abandoned, there were considerable troubles, and the retorts had to be entirely renewed after the first winter's work, notwithstanding which we never regretted their adoption. After their renewal, they lasted longer than any retorts on the works had previously done. Similarly, the first settings of inclined retorts in 1890 gave even greater trouble than any we have had with the verticals, and some of the retorts did not last three months. The difficulties were, however, overcome, and eventually the introduction of the system in which we were then pioneers was not regretted.

The difficulties encountered have meant very hard work for the staff, but not reduced profit to the Corporation. The profits of the undertaking have been maintained, the price of gas has been reduced, and the make of gas per ton of coal has been increased.

Dr. Leonard Hill on Radiators.—In the course of an interview last Thursday, Dr. Leonard Hill, Professor of Physiology at the London Hospital, made the following remarks, according to the "Daily Mail," on the subject of heating by hot air and radiators without flues. "What is required," he said, "is a source of radiant heat provided with a flue so arranged as to draw cool, fresh air into the room. This air ought to be kept in gentle motion. A room heated uniformly, with the air almost motionless, is injurious, because the air acts monotonously on the nerve system, and is entirely contrary to the conditions which exist out of doors. The open fire is the ideal form of heating; and where a fire is not possible, ventilation fans should be used. From a health point of view, these should be regarded as essential."

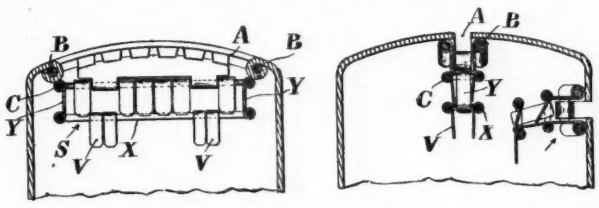
REGISTER OF PATENTS.

Coin-Retaining Device for Coin-Slot Money-Box.

ASBURY, L. P., of Handsworth, near Birmingham.

No. 24,262 (of 1911); redated Dec. 12, 1912.

In connection with coin-slot money-boxes, various arrangements have been previously proposed, the patentee points out, for preventing the extraction of coins by way of the coin slots—one arrangement being to provide on the inner side of the slot a depending tubular passage of chain-mail so as to form a collapsible passage, and another arrangement has non-return catches which admit of coins freely entering the box but stop their return by way of the coin-slot.



Asbury's Coin-Meter Money-Box.

Vertical sections (at right angles to each other) are given of the present patentee's proposal—showing a portion of the money-box only. S is the coin-retaining device (providing a somewhat tubular formation immediately below the coin-slot A) rigidly secured to hang from the underside of the slot by portions of the metal of the body at the ends of the slot being pressed downwards and outwards to clinch around the ends of a rectangular wire frame B forming part of the tubular chain. From the lower rectangular wire frame C is loosely suspended a rectangular wire link X, and also a number of loosely swinging flaps. The frame X is suspended at each end by a loosely applied wire hanger Y, in such manner that it can rock both longitudinally and transversely, while the flaps can swing transversely of the link and are limited in their outer swing by their free ends entering the next link below. The link X and the flaps may be duplicated if necessary below, but only one link is shown in the drawings with a number of loosely hanging additional flaps V hanging below it. This arrangement of coin-retaining device prevents coins being extracted from the interior of the box by way of the coin-slot.

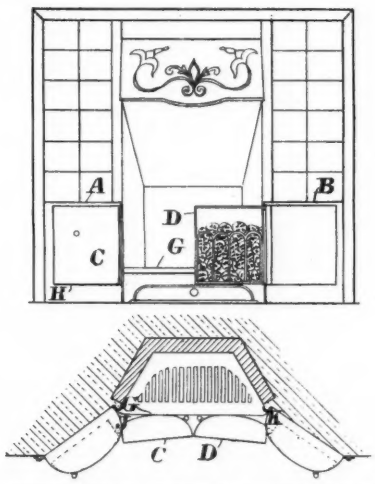
Instead of the coin-slot and coin-retaining device being arranged through the top or crown of the box, they may be arranged at the side of the box, as indicated at Z (in the second section); its action in retaining being exactly similar.

Fire-Grates for Solid Fuel or Gas.

HOLLIDAY, H. H., of Cheam, and STEVEN, A. K., of Upper Thames Street, E.C.

Nos. 7844-5; April 1, 1912.

The inventors provide a hob at each side of the fire-place. The basket for the solid fuel is fixed in the ordinary manner; the basket for the gas-fire is formed in two halves, which, when in use, lie close together in front of the coal-basket. When the gas-fire is not in use, the halves of its basket are turned so that they lie within the receptacles formed by the hobs.



Holliday and Steven's Convertible Gas and Coal Grate.

The illustration shows an elevation and sectional plan of one way of arranging the gas-fire basket.

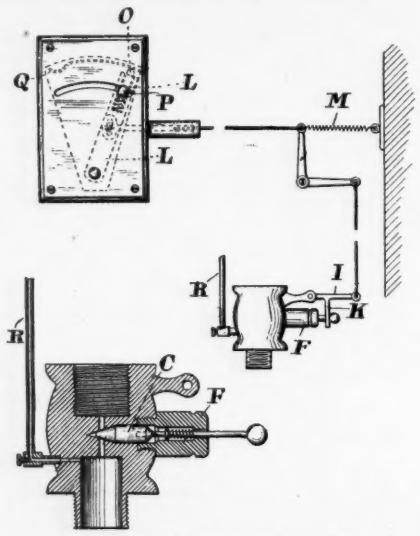
The hobs A B, at the sides of the fire-grate, constitute receptacles for the two halves C D of the hinged gas-fire basket, so arranged that when in use they lie close together in front of the coal-basket G, as shown in the plan. When the gas-fire is not in use, the halves of the basket lie in recesses H I formed in the hobs, as indicated on the left of the elevation.

Controlling the Supply of Gas from a Distance.

BURRELL, P. J., of Bournemouth.

No. 9186; April 18, 1912.

This invention has particular reference to apparatus for controlling from a distance the supply of gas to burners in which a horizontally disposed valve is employed in combination with a controlling lever connected to the valve body, whereby a vertical pull imparted to it will give an outward movement to the horizontal valve stem.



Burrell's Distance Gas Controller.

An illustration is given of the apparatus complete, and a sectional elevation of the valve and valve fittings.

The valve body of the gas supply pipe is formed with a bore which crosses the passage for the supply of gas to the burner. Within this cross bore is fitted a valve spindle or plunger C, formed with a cone-shaped valve extremity which fits into a correspondingly shaped seating at the rear of the valve body. The plunger at its opposite end is fitted with a stem which passes through a hole in the end of the cap or cover F, which is externally threaded to engage with a tapped hole in the valve body. Upon the shank of the stem, within the cap, is mounted a spiral spring, which is normally in a state of compression, and forces the valve against its seating. The valve is regulated by a lever I, which is pivoted to lugs on the valve body, and is furnished with a downwardly extending arm K, formed with a forked extremity which strides the stem of the valve, and is so devised that with the upward movement of the lever I it will bear against the head of the valve stem and open the valve by drawing out the stem against the resistance of the spring.

A wire connection made with the free extremity of the pivoted lever may be directly connected to the switch lever L mounted on a board fixed (say) to the wall of a room; a spring being introduced to draw the wire between this point and the switch into the "off" or normal position when the switch is released, or the latter may be attached to quadrants or pulleys or the like so as to take any necessary turns prior to being connected to such switch lever. A spring M, connected to the first quadrant, in such case serves a similar purpose to that just described. The switch lever L (fitted with a knob P) is provided with a spring push piece O, which engages with the curved end Q in the "on" position.

The valve is to be employed in addition to the ordinary gas-tap and be fitted with the usual bye-pass R.

Gas Analyzing Apparatus.

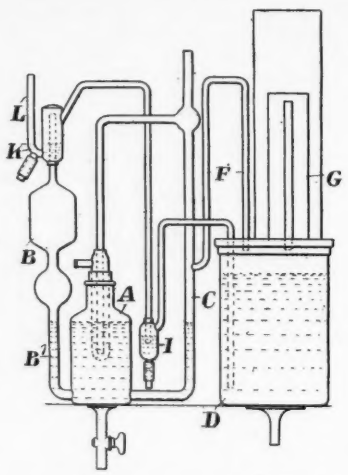
INGENIORSFIRMA FRITZ EGNELL, of Stockholm.

No. 29,211; Dec. 28, 1911. Convention date, Dec. 29, 1910.

In apparatus to which the invention refers, the patentees point out, it has heretofore been proposed to transport, by the action of a hydraulic pump or other suction device, small quantities of the gas to be analyzed from a measuring tube or vessel to the bottom of an absorption vessel through a pipe containing a liquid seal—the pipe in some instances being non-branched. But the gas passes freely over the surface of the liquid in the seal and does not bubble through it before reaching the absorption vessel. In other instances, the connecting pipe is branched; but the gas, in passing from the measuring vessel to the absorption vessel, bubbles through the liquid in the seal contained in the pipe.

The object of the present invention is to provide apparatus in which a liquid seal is formed between a fresh gas supply pipe and a measuring vessel, and in which a separate liquid seal is provided in a non-branched pipe one end of which communicates with the top of the measuring vessel, above the first-mentioned seal, and at its other end with the bottom of an absorption vessel. The last-named liquid seal in the non-branched pipe is so arranged that gas, in passing from the measuring vessel to the absorption vessel under the action of an hydraulic pump, has to bubble through the liquid contained in the seal. Thus means are provided for effectually preventing the absorption liquid in the absorption vessel being sucked into the pipe containing the seal and into the top of the measuring vessel.

By these arrangements, the following advantages are said to be gained: Firstly, no gas remainders from each foregoing absorption can assemble in a branch pipe, thereby commingling with fresh gas to be analyzed in the following absorption; and, secondly, the gas between the liquid seal in the non-branched pipe and the absorption vessel is continually compressed, so that at each compression stroke of the pump, when the gas is forced from the measuring vessel to the absorption vessel, no compression work is to be effected for compressing once again such gas quantities as have been previously compressed.



A Swedish Gas Analysis Apparatus.

The operation of the apparatus shown is as follows: The vessel B is supposed to be filled with gas which at the preceding stroke of the pump A has been sucked in from L. The pressure medium thus introduced will be forced to the pipes B^1 and C. At first when the mouth of the pipe F is not closed by the liquid rising in C, the gas pressed by the rising liquid from B through I to D can escape through the pipe F. As soon, however, as the mouth of the pipe F is closed by the liquid rising in C, the gas in D will be forced during the rising of the liquid in B into the bell G, which will then rise. As soon as the liquid has risen in B to its upper part, the pressure medium in A, on account of the construction of the pump, will cease to act, whereby the liquid in B and C will flow back to A. Fresh gas is then sucked into the vessel B from L through the liquid seal K; the liquid seal I preventing the liquid in D from being sucked into the pipe E. As soon as the mouth of F is opened by the liquid in C sinking beneath the mouth, the gas just analyzed is pressed out from G through F and C, which is open at its upper end. Finally, the mercury levels in A, B^1, and C will be as shown, whereby the pressure medium begins to act on the liquid in A as described, thereby forcing the liquid into B^1 and C and the operation described is repeated.

Gas Analysis Apparatus.

SIMMANCE, J. F., of Westminster Palace Gardens, S.W., ABADY, J., of the Inner Temple, W.C., and WOOD, F., of East Sheen, Surrey.

No. 11,664; May 16, 1912.

This invention relates to apparatus for automatically drawing in successive samples of a gaseous mixture, measuring off a definite volume at a constant pressure, passing it through an absorbent, and thence to a measuring vessel connected to a recording apparatus, by means of which the amount of the constituent absorbed is recorded on a chart suitably indicated.

In many types of such apparatus, the patentees remark, the gas is measured before and after absorption by displacement over water, and means are well known by which the water is saturated with the gas and kept in circulation, so that the gas is measured at the same temperature before and after absorption. In patent No. 26,168 of 1910, there was described a method by which the recording portion of the apparatus is automatically put into and out of action by the sealing and unsealing of a tube. The present invention relates to a similar method of extracting, measuring a definite volume at a fixed pressure, analyzing, and remeasuring the successive samples—the operations being performed by the known device of a fixed extractor vessel and a rising and falling liquid, instead of by a rising and falling extractor vessel in a chamber containing a fixed level of liquid. They arrange that the water used in the apparatus overflows from one vessel to another, whereby the liquid levels in the various vessels are kept constant, and the temperatures of all the vessels are maintained equal; and special means are provided by which the water is saturated by the gaseous mixture before coming in contact with the sample to be analyzed. The apparatus can be adapted for simultaneously effecting two or more separate analyses for the same constituent of separate samples drawn from separate sources, or two or more separate analyses for different constituents of samples of gas, from the same source.

Fig. 1 shows the apparatus in diagrammatic form. Fresh water running through it actually comes in contact with, and is saturated by, gas drawn from the same source as the sample to be analyzed. Such water is first saturated or impregnated with the gas before it enters the gas-chamber in which the sample is collected; "so that the latter suffers no loss of its absorbable constituents, as would be the case if collected over water not so impregnated." The water is made to circulate in such a manner through the various tanks that the temperature is equalized in the gas-chamber in which the sample is collected and that in which it is remeasured after passing through the absorbent.

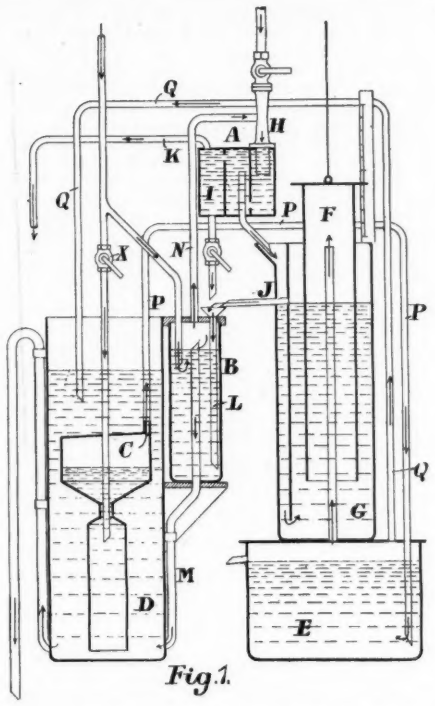


Fig. 1.

Simmance, Abady, and Wood's Gas Analysis Apparatus.

Further, the water levels in the tanks are kept up continuously to their proper heights.

The water-cistern A is fitted with a pump for drawing up the gas and injecting it through the water. It is arranged with supply pipes and a regulating device for supplying the tanks; a gas and water impregnating chamber B, in which the gas is again passed through the water before it enters the extractor chamber; a gas-extractor chamber C, in which the sample is measured off; a water-tank D, fitted with a syphon pipe for the extractor chamber; a tank E with gas inlet and outlet pipes to contain the absorbing liquid; a movable bell F, with an indicator and scale of parts in which the sample is remeasured after absorption; a water-tank G for the bell, with a water inlet at the bottom and an outlet at the top in such a manner that the water is continually circulating through the tank; and a clock and pen arrangement for automatically and continuously recording the results of the analyses on a chart.

The action is as follows: Water enters through the filter pump nozzle at H, flows under the dividing plate, and fills up the middle chamber of the inlet cistern A till it overflows and runs into the chamber I. The central chamber is provided with a small hole below the surface level. Some of the water therefore flows at a constant rate to the tank G of the recording bell. The water in the right-hand compartment of the inlet cistern maintains the same level as in the centre one, and so seals the end of the filter pump, and gas is at once drawn along the horizontal arm of the filter pump and injected through the water. The water flowing from the small hole in the centre chamber passes through the tank G, entering it at the bottom and passing out through the overflow at J away to the waste-tank, or into the gas and water chamber B, as shown. Thus, the water in this tank is always at the same temperature as that in which the gas is first collected and the correct level is always kept up. The water overflowing from the tank A passes through a regulating tap and into the gas impregnating chamber B. By adjusting the tap the speed of the analyses can be varied without disturbing the level in the tank G or checking the rate of flow of gas being injected, as the surplus water passes to waste down an overflow pipe K.

The stream of water now enters the gas and water chamber B, passing down the pipe L and entering the syphon tank D by the pipe M. The space above the water in the chamber is connected to the gas inlet branch of the filter pump by the pipe N, so that a partial vacuum is created. Gas is drawn from the main supply pipe O, and enters the chamber B by a pipe which dips below the level of M. Thus the gas again bubbles through the water before the latter enters the extracting chamber. As the gas and water chamber is constructed with glass sides, the gas can be seen bubbling through the water, which forms a useful guide as to the condition of piping from the source of supply—any undue resistance to the free passage of gas along the pipe line, owing to any obstruction, being shown by air bubbles being drawn down the pipe L

The water fully charged with the soluble constituents now enters the syphon tank D, and, rising up in the extracting chamber C, forces the gas therein out through the pipe P, and so through the absorbing reagent, with which the tank E is filled. When the rising water has entered the narrow part of the extractor chamber, the outer water in the tank D closes the end of the vent pipe, and the remaining fixed volume of gas passes up under the bell F. The water still ascending enters the small outlet pipe P until the syphon comes into action and automatically discharges the tank. The water, retiring, opens the vent tube Q and allows the old sample to be discharged, and a fresh sample from the main pipe O is drawn in; and the operation is repeated.

The apparatus is so arranged that the fixed volume sent forward is just sufficient to raise the moving bell F over a scale of 100 parts when none is absorbed in passing through the absorbing reagent. Therefore, when used for the analysis of a gas, such as furnace gas, containing carbon dioxide, some of it is absorbed in passing through the potash solution; the original volume is lessened by this amount; and, consequently, the bell cannot rise so high, but comes to rest at a point on the scale depending on the volume of gas that has been absorbed, and so indicates the percentage volume of carbon dioxide in the particular sample. By a pen and clock arrangement, the results of the analyses are recorded on a chart in the usual method.

For convenience in checking zero, a two-way cock opening to air is provided at X on the gas inlet to the extractor chamber, so that a charge of air can be drawn into C and the movable bell made to rise from 100 to 0. Any slight deviation from the zero can be rectified by a small adjustable weight on the balance arm from which the moving bell is suspended.

When it is required to analyze for the same constituent a number of samples of gas drawn from separate sources, sets of the apparatus, one for each source of supply, are arranged in multiple in such a manner that separate streams of gas are brought up to the apparatus, from each of which streams small samples are automatically cut off and analyzed as described. Where possible, essential parts of the apparatus, such as the syphon tank, water inlet tank, and recording bell tank, are made common to all the sets. The results of these separate analyses are then recorded on one common chart operated by clockwork by means of separate pens working in conjunction with, and controlled by, the various rising bells or movable gas-chambers—the pens all moving on the same ordinate, each within its particular range and having its own particular zero line on the chart.

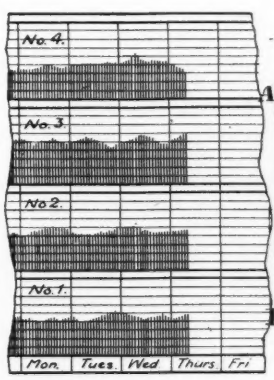


Fig. 2.

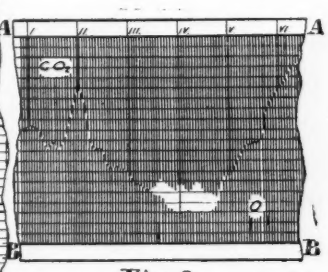


Fig. 3.

Fig. 2 shows a portion of such chart from a multiple CO_2 recorder dealing with four separate and distinct gas supplies, as would be obtained from the flues of a bank of four steam-boilers.

By duplicating the extractor, absorbing, and remeasuring chambers, and using suitable reagents, the apparatus can also be arranged to collect two separate samples of the same gas for the purpose of determining the percentage volume of two different constituents; the results being recorded on one chart by means of a multiple recording apparatus with two separate pens operated respectively by the two moving gas-chambers.

The multiple recording apparatus with two pens may be arranged so that the chart shows by difference the percentage volume of a third constituent of the gas. Thus, if the percentage of one constituent (A), as determined in one measuring chamber, be recorded on the ordinate of the chart by a pen mark set off upwards from the zero line, and the percentage of another constituent (B), as simultaneously determined in the second measuring chamber, be recorded on the same ordinate of the chart by a pen mark set off downwards from the 100 per cent. line, the length of the ordinate between the two pen marks is a record of the percentage of the constituent (C), which is the sum of all constituents other than A and B.

Further, if the gas being analyzed always contains a constant volume of a third constituent, then the chart and two pens may be arranged so that the difference between the two records shows the volume of a fourth constituent. Thus a full analysis of the combustion products from a furnace can be made. One part of the apparatus would determine the amount of carbon dioxide, the result of which would be recorded on the chart (fig. 3) by one pen moving across from zero at one side (AA) of the scale and marking the amount of carbon dioxide; the actual percentage of the constituent being shown by the length of the line drawn by the pen from the zero line AA. The other analyzing set would determine the volume of oxygen in another sample drawn from the same source. The result of the second analysis would be shown on the chart by a second pen (operated by the second moving gas-chamber), which would move in an opposite direction to the first pen from its own zero line (BB), which would be coincident with the 20 per cent. line of the carbon dioxide pen. The volume of the oxygen would be also shown positively by the length of the second mark—both pens starting from, and returning to, two separate zero lines by the action of detents which are brought into operation when absorption is completed. As the volume of nitrogen may be assumed to be constant at 80 per cent., the unmarked space on the chart between the two pen marks would be the value of the fourth constituent (carbon monoxide, if present). The chart so obtained is illustrated in fig. 3.

Similarly, the multiple recording apparatus with two pens may be used for analysis of blast-furnace gas or producer gas. One analyzing set would determine the percentage of carbon dioxide present in the gas, and the amount would be recorded by one of the pens. In the other analyzing set, the sample of gas would be drawn through an oxidizing chamber containing a suitable reagent, heated, if necessary, and then through the absorbing and remeasuring chambers; the absorbing chamber containing a reagent to absorb the carbon dioxide.

The volume of gas in the remeasuring chamber would be that of the nitrogen present in the gas, which had not been affected in the oxidizing and absorbing chambers. The chart would then be as shown in fig. 4, and would indicate the volume of carbon dioxide, the volume of nitrogen, and the volume of combustible constituents present

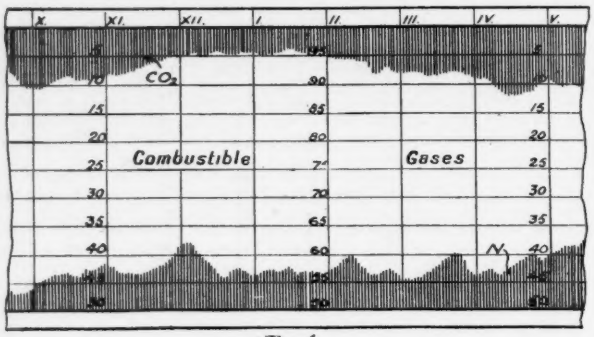


Fig 4.

in the gas. Since the percentage of nitrogen in producer gas and blast-furnace gas is high, the pen which records the amount of nitrogen may start at any convenient line—say, 50 per cent.—but it would be brought into action by the moving measuring bell starting from the 100 per cent. line.

APPLICATIONS FOR LETTERS PATENT.

29,516.—Stevens and Williams, Ltd., and Williams-Thomas, J. S., "Combined shade and reflector." Dec. 23.

29,518.—Barralet, T. E., and Parkinson Stove Company, Ltd., "Valves for water-heaters." Dec. 23.

29,526.—Oglesby, S. W., Ayton, F. R., and Hugh Stevenson and Sons, Ltd., "Boxes for mantles." Dec. 23.

29,588.—Fletcher, C. G., "Gas-engines." Dec. 23.

29,594.—Hawkswell, H., "Gas-boilers." Dec. 23.

29,619,—Woodall, H. W., "Operating vertical gas-retorts." Dec. 23.

29,654.—Hoeller, W., "Gas-furnaces." Dec. 24.

29,691.—Windhoff, H., "Gas-engines." Dec. 24.

29,693.—Mellersh-Jackson, W. J., Pressure-gauge testing devices. A communication from R. C. Cox and F. A. Wyman. Dec. 24.

29,714.—Clarke, H., and Carmichael, J. T., "Distillation of carbonaceous substances." Dec. 24.

29,759.—Tully, C. B., "Time meter." Dec. 24.

29,883.—Holzwarth, H., and Junghans, E., "Gas-turbines." Dec. 28.

29,893.—Brown, W. H., "Gas and water valves," Dec. 28

29,928.—Gill, J. H., "Controlling the period of artificial illumination." Dec. 30.

29,934.—Kershaw, R., "Suction gas plant." Dec. 30.

29,942.—Weyres, H., and Schwarz, E., "Incandescent gas-burners." Dec. 30.

29,998.—Deutsche Licht Industrie G. m. b. H., "Incandescent burners." Dec. 30.

Electric Light Failure at Brighton.

Some inconvenience was caused in Brighton last Friday night by the failure of the electric light. The eastern part of the town suffered most—the Palace Pier being the principal place of amusement affected; while the Aquarium and the Madeira Road Shelter Hall, in which the "Jack Sheppard" variety company were giving an entertainment, also found themselves in difficulties. At these places the electric light failed absolutely for from seven to ten minutes. Gas was fortunately available at the Shelter Hall, and the entertainment was proceeded with by this light. At the Aquarium also the band performance was conducted by gaslight. The Winter Garden at the Palace Pier was well filled with people when the darkness descended suddenly upon them. All kept their seats, and eventually a small hand electric lamp was requisitioned. This threw a gleam of light across the audience; and the band played until the light was restored—their custom of not using any music standing them in good stead. An official explanation of the occurrence was given to a representative of the "Sussex Daily News" by Mr. Christie, the Corporation Electricity Engineer, who was interrupted by the failure of the light while delivering a lecture at the Brighton Pavilion. He stated that one of the bands holding the armatures on the 460-volt motor generator, supplying the northern and eastern districts, broke while the machinery was working, and thus caused a short-circuit.

The Modern Gas-Fire.—The current number of the "Builder" contains an article on "Gas as Fuel." The writer points out that the old form of gas-fire depended to a large extent for its efficiency upon convected heat obtained by passing the hot products of combustion in a tortuous passage through a metal channel before they were discharged into the flue. Now these channels are abandoned. The objective of the modern gas-fire is, he says, "to convert the largest possible proportion of the heating value of the gas into radiant heat and less into convected heat; and that the changes which have been made in the form of construction are appreciated is proved by the extraordinarily large number of modern forms of fire which have been sold during the last three years."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas Analysis Methods.

Sir,—Dr. Bone's letter of Dec. 31, on the above subject, appears to me to be a confirmation, from an eminent authority, of the point I have been endeavouring to make in respect to gas analysis. I think it will be generally agreed by those accustomed to analysis that it is not practically possible to make several analyses daily, and (if the explosion method is used) to be sure of the results shown for hydrogen and methane; and, further, to take nitrogen by difference is not a good practice.

The use of the copper oxide combustion does not rest upon my advocacy, but is a method the accuracy of which has, I think, been well established for a very long time. Copper oxide, of course, will oxidize other constituents besides hydrogen, at a dull red heat (carbon monoxide, for instance), if they are present; but what I directed attention to in my article was a sound method of examining gas from which these constituents have been previously removed.

This seems a suitable opportunity of answering a question you put to me in your article on p. 948, in which you ask whether I am suggesting that the legislative calorific standard requires supplementing, or whether supplementary tests by gas makers are desirable as part of the routine of gas manufacture, in order to supply the best possible commodity to the consumers. My answer to the question is that it is the latter to which I tried to give emphasis in the article on "Calorific Control of Gas Making."

Westminster Palace Gardens, S.W., Jan. 2, 1913. Jacques Abady.

"Competition Points for Gas Salesmen."

Sir,—It may not be within the knowledge of all your readers that there is a monthly periodical identified with the gas industry known as the "Gas Engineer's Magazine;" but as it no doubt comes under the notice of some gas managers, I shall be glad if you will, for their information and interest, publish a letter that I recently addressed to the Editor of the "Magazine," regarding a reference that he made to the little book for the issue of which I am responsible. I would not have suggested any allusion to the matter in the "Journal," but that the Editor, having published certain statements not altogether complimentary to the book, has now written to me to say that he sees no reason for the publication of my letter, but will make a "*short* reference to the same in the next number of the 'Magazine.'" Courage and courtesy are not conspicuous features of the decision. Of this, your readers may judge for themselves by having before them the notice of the book and the letter *in extenso* that I addressed to the Editor of the periodical named.

This is the so-called "Review" of the book:

> This book is admittedly a "compiliation;" and on *looking through it* there does not seem to have been any settled scheme in the preparation of the volume; it is designed, we believe, to be a sort of enquire within upon every argument that can be offered upon gas *versus* electricity, with, we must admit it, considerable bias for gas. Much that Mr. Bezant quotes has served its purpose both for and against; but it is really too absurd to expect the gas salesman to possess himself of such facts and figures as the author has culled from utterances by all sorts and conditions of men, in order to be able to answer the arguments of prospective gas consumers. A good salesman must thoroughly know and understand the article he sells, and be perfectly confident of its advantages to the buyer. But he is not a good salesman if he only sells his goods by depreciating those offered by an opposing firm or exposed for sale in another shop. Life is too short, and business too strenuous, in these days for any man to consult a book for arguments against an opposing firm's goods. The gas salesman of to-day is the man in the service of a gas undertaking, who, above all others, needs to know his own business, and has not the time nor, we think, the inclination, to worry himself about the doings of others.

The following is the letter I addressed to the Editor of the "Gas Engineer's Magazine," and which he declines to publish, but proposes to dispose of by a "short reference" in his next issue:

> I would not have troubled you with a letter referring to the extraordinary and ridiculous allusion to my little book (or, as you describe it, "compiliation") in your last issue; but I am a little curious to learn your real reason as to why a gas salesman should not have a book of reference, and why the salesman's equipment should not include a knowledge of the goods—in this instance represented by light, heat, and power—of his competitors? The electricity salesman knows, or pretends that he knows, a great deal about what the gas salesman has to offer; and the electricity salesman makes considerable use of the knowledge, actual or assumed. The gas engineer has his "Handbook" and other text-books, the gas chemist has his text-books, the electricity salesman has his "Electricity for Everybody," and why should not the gas salesman have a book of reference supplying him with comparisons and authorities, from which book he can prime himself without wasting time in making extensive search for information on his own account? It is not a sufficient reply to my question to childishly babble about "life being too short, and business being too strenuous" to allow time for consulting books. If business is strenuous for the gas salesman, it is also strenuous for the gas manager; but I suppose there are to be discovered gas managers who find time to devote even to the reading of the "Gas Engineer's Magazine."
>
> However, it is not the Editor of the "Gas Engineer's Magazine," nor the manager of a gas undertaking, nor even the gas salesman himself who finally determines the knowledge the last-named must possess; but it is the customer who "wants to know," and asks questions accordingly. Preparedness on the part of the gas sales-

man for defence is equally as important as—perhaps more so than—preparedness for attack.

As to the contents of the book, I am inclined to think that the person who wrote the reference to it would not care to face an oral examination on all the matters included in it; and yet I take it that the writer of the notice, as the self-constituted judge of what a gas salesman ought to know and ought to do, would have people believe that he has himself a complete and comprehensive grasp of all these matters.

The best reply to the foolish allusion to the book is that I have received, without solicitation, from many men of high position in the gas industry—higher in technical, administrative, and commercial attainments in the industry than the writer of the notice of the book—letters expressing appreciation of its value. What is also highly gratifying is the character of the sale of the book. After a sample has been purchased and examined by the heads of gas undertakings, it has been the invariable experience that repeat orders have been received—repeat orders varying from two up to 150 copies. Thus the total sales during the few weeks of publication have far exceeded my most sanguine expectations; and, as a rule, the producer of a book has *very* sanguine expectations. Another interesting and pleasing point is the number of employees connected with the outdoor staffs of gas undertakings—some of them working fitters—who have on their own account become possessed of the book. Is more substance than this required as an answer to your futile comment? I think not.

While writing, there comes to hand a note from a well-known gas engineer who for years has had to meet keen competition from municipal electricity; and referring to the book, he says, "very useful to an old campaigner." The "Magazine" comment on the book and its purpose may, with my letter, stand without further trespass on your space.

Jan. 2, 1913. ARTHUR F. BEZANT.

Gas-Works Pitch Industries and Cancer.—With reference to the notice which appeared in last week's "JOURNAL" (p. 1040), of a pamphlet bearing the title of "The Problem of the Gas-Works Pitch Industries and Cancer," Mr. W. J. A. Butterfield writes to say that possibly the pamphlet conveys a misapprehension as to the defraying of the expenses of the investigation, in so far as the assistance which he has given to Dr. Ross and his colleagues at the Lister Institute is concerned. This assistance was given by him unprofessionally; and it is only the expenses of the work at the Lister Institute which fall upon the "John Howard M'Fadden Research Fund."

LEGAL INTELLIGENCE.

Conviction for Defrauding the Ryde Gas Company.

On Monday last week, the Ryde Borough Bench had before them three charges brought by the Ryde Gas Company against George Spencer (32), described as a steward, of stealing money from prepayment meters; the sums being 6d., 6s. 9d., and 7s. respectively. In the first case, marked coins were put into a meter. Subsequently the accused was detected upon the premises; and on being taken to the police station and searched, the coins were found upon him—the locked cash-box on the meter having been forced. In the second case, one of the Company's collectors deposed to finding the lock broken off the meter and the cash-box empty—it having been forced in a similar way to the other. Accused was charged with the offence, and fully admitted it. He put in a long written confession, in which he expressed regret at appearing for a second time before the Magistrates, and attributed it to drink. He asked them to deal leniently with him, as on the previous occasion, and promised to do his best to obtain work, and return to the Company the money he had stolen from them and compensate them for the damage done. The Chief Constable said the case the prisoner had referred to was one where he stole £2 from a house, and was bound over for six months—which period had not as yet expired. The Chairman (Mr. H. H. Pallard), said the prisoner seemed to have deliberately set himself to defraud the Gas Company; and he would have to go to prison for two months with hard labour.

Former Gas Company's Secretary Charged with Fraud and Perjury.

At the Bow Street Police Court last Saturday, before Mr. Curtis Bennett, Robert Henry Rushforth, a Solicitor, and Clerk to the Justices at Amersham, was charged on remand with forging and uttering a receipt for £40 purporting to be signed by Miss Anna Mary Grimsdale, of Hove. The case was reported in the last number of the "JOURNAL" (p. 1058). Mr. Travers Humphreys, who conducted the case on behalf of the Director of Public Prosecutions, said it was now proposed further to charge the prisoner with forging and uttering three other receipts—two of them for £20 each, and one for £40; and also for committing perjury in two affidavits which were produced by him in the High Court. At the previous hearing, it was stated that the whole of the money due from the prisoner to the shareholders was paid by him a few days after he had produced the receipts. Miss Grimsdale gave evidence that she was formerly the holder of eight £5 shares in the Amersham Gas Company. The receipt [produced] for £40, dated Sept. 2, was not signed by her, and she did not receive the money on that date. She received a cheque for £40 from the prisoner on Sept. 21; and she did not notice that it was dated a good many days before that day. Another lady stated that on Sept. 21 she received from the prisoner a cheque for £20 in respect of four £5 shares which she formerly held in the Company. The receipt, dated Sept. 2, for this amount, purporting to bear her signature, was a forgery. Precisely similar evidence was given by the sister of the last witness, and the prisoner was again remanded on bail as before.

MISCELLANEOUS NEWS.

A GOOD BEGINNING.

The first article in the current number of the "Bulletin" of the British Commercial Gas Association bears the above title, and is signed "F. W. G."—initials of which our readers will have no difficulty in recognizing the owner. It is worthy of reproduction in full.

With the sands running quickly out of the glass for 1912, it is natural to look back and endeavour to form a calm judgment upon what has been accomplished within the year and an estimate of what the future has in store.

WHAT HAS BEEN ACHIEVED?

First of all, the Association has become an established fact. The preliminary work necessary to its formation on a basis broad enough to secure initial success occupied a long time; but, under the circumstances and conditions, the time of preparation was not too long, for a premature start would have brought disaster.

Indeed, some of our supporters were inclined to think that we were, if anything, premature in starting before a longer list of subscribers had been obtained. They feared lest, having opened, at the expense of some, a campaign which was bound to benefit all, those who had not joined would refrain from doing so, because they would be getting the benefits without subscribing.

It was felt generally, however, that this was a view which ascribed to the administrators of non-subscribing undertakings an incredible degree of meanness; and that there was no ground for such a reflection upon the fair-mindedness and public spirit of the great majority of Directors and Councillors having charge of the gas undertakings in these islands.

It was believed by the majority of those who were responsible for the publicity movement that there were other and far more respectable (though in their opinion not adequate) reasons which kept many undertakings from giving support to the Association at its inception; and that once those reasons were proved to be without foundation, once the necessity and value of the Association were established, increasing support for its work would be forthcoming.

WHAT WERE THE OBSTACLES TO UNIVERSAL SUPPORT IN THE BEGINNING?

In the first place, there were a certain number of gas administrators who failed to realize the necessity for taking any active steps to increase the sale of gas. The output in their districts had increased and was increasing; they had paid a good dividend for years; why not leave well alone? What need was there for any change?

Unfortunately, there are still a number of these doubters still unconverted, and, indeed, it is not easy to argue with a man who takes that line of opposition. The very success of the Association in stimulating business throughout the country may even serve to strengthen him for a time in his belief that "there is no need to do anything," because he does not realize that something is being done—at the expense of others. But there is this to be remembered—that those undertakings profit most by the work of the Association which are most active locally in stimulating the sale of gas. National publicity must be backed up by local publicity, and by the rendering of good service by the local undertaking to its individual customers, if much of its power is not to be lost.

We know, therefore, that the board or committee which has not yet realized the need for any improvement upon the old method of selling gas (the method consisting in just supplying as much gas as the public will use without being taught in how many ways it can and should be used) benefits least by our work, and is bound, sooner or later, to come to the point of realizing that new days demand new ways. Such an undertaking is then very likely to turn to the established organization for helping to develop the sale of gas, as, indeed, some undertakings have already done when they have found themselves faced by new forms of competition.

Then there were others who, realizing in some measure the need for publicity work, thought that it was sufficient for each undertaking to do its own. "We have done a great deal to push the sale of gas in our district," they said, "for years past. We do not want anyone to show us how to conduct a publicity campaign; and what money we can spare for publicity we can best spend at home."

It has been pointed out to those who held this view, first, that every business can "afford" to spend, and ought to spend, every penny upon sales development that will bring a profitable return. It is not a question of what you can "afford" to spend, but of what you can profit by spending. Successful soapmakers do not say: "Can we afford to spend £100,000 a year on advertising our soap?" They say: "We find it pays us better to spend £100,000 a year on advertising than to spend a smaller sum;" and they proceed to spend the larger amount.

Further, it has been pointed out that there is a multitude of vehicles for advertisements which every successful merchant who has anything to advertise for universal sale uses, because it pays him to do so, but which no individual gas undertaking can profitably use because of the limited benefit that it would derive from their wide-spread circulation.

Gas undertakings combining to use these wide-circulating organs of advertisement, as supplementary to advertising individually each in its own locality, may be compared to citizens combining to light and cleanse their streets out of a common fund, in addition to each lighting and cleaning his own house or shop at his own expense. Both are essential to the welfare of the city (or the industry); neither is sufficient in itself. We, however, as an Association, are in the position of a town worked on the voluntary rate system. We have to rely upon the good citizenship of all to bear willingly their share of the work done for the benefit of all.

Further, it has been pointed out that the books, pamphlets, posters, post-cards, illustrations, show-cards, and other advertising matter required for an effective publicity campaign can be produced far more

economically and efficiently in bulk by a central organization than in small quantities locally. This has been conclusively proved by the experience of the subscribing undertakings who are buying from the Association ever-increasing quantities of advertising matter.

Then, again, there were at the commencement a goodly number who said: "We recognize the need for the work, but we are not sure that this is the right way to do it. Show us that you are on the right lines, prove that you can do good and useful work, and we will give (or increase) our support."

This was, it was pointed out, asking us to make bricks without straw. But as there were enough who had faith to provide the straw first and to wait and judge the bricks later, the Association was formed. It got to work in April last, and here we are at the end of the calendar year taking stock of the situation.

REVIEW OF THE SITUATION.

What do we find? Have our arguments been successful? Has our work proved its utility and its value?

Well, in this case, as in most others, there is no better test of success than the financial one. Directors and councillors would not renew or increase their subscriptions to an Association if they did not approve its policy, or if they had not been satisfied with its work. Nor would undertakings which formerly hesitated to subscribe add their names to the list of supporters unless their observation had satisfied them that the cause was worthy of their backing.

Judged by that standard—and it is the crucial test—we can say at the end of 1912 that we have made a good beginning. It is true that, with Shelley, we may, if we think only of our ideal, "look before and after, and sigh for what is not," because we are still a long way from our cherished aim of "all for one and one for all." But, taking a practical view of the situation, we see real, substantial, gratifying progress made towards that ideal.

As will be seen from the recent report of the Executive to the General Committee,* those who stood aside at first are steadily coming in; those who gave us partial support at first are giving full support now—notably in the cases of Dublin, Glasgow, and Oldham; and those who gave full support at first are renewing their subscriptions readily and with many expressions of satisfaction. And ever since that report was presented the tide of progress has flowed steadily on; so that, whereas the first number of the "Bulletin" contained the names of but 223 subscribing undertakings, this issue sees the number increased to 290, with every prospect of considerable further additions in the near future.

Broadly, this sums up the achievements of 1912. Reference might be made to the first Annual Conference, to the large sales of literature, to many other evidences of successful activity and of progress. But we are now concerned rather with the whole picture than with its details; and the salient feature of the whole is the steadily growing financial support that is being received.

NEED FOR INCREASED SUPPORT.

This means that the expenditure on publicity during the year ending the 30th of September next will be on a considerably higher scale than during the past year, though it will still not be one-half of what it should be if the best results were to be attained. The result of increasing our publicity expenditure (as it will be increased during the next nine months) by 40 per cent. will probably be to increase its effectiveness by 100 per cent., because in advertising each successive £1000 spent is (up to a limit which we are very far from reaching yet) more productive than the last, as it is cumulative effect that brings results.

This increased expenditure will, undoubtedly, bring the Association steadily increasing support; and so we turn our faces towards 1913 with a feeling at once of high confidence and of high responsibility—believing that great things can be achieved for the industry in the coming year if the affairs of the Association are administered with wisdom and energy, and hoping that those of us upon whom the administration rests may not fail seriously in the fulfilment of our responsible task. In facing that responsibility, we perhaps cannot do better than adopt the philosophy of Abraham Lincoln when he wrote:

> "I do the very best I know how—the very best I can; and I mean to keep on doing so until the end. If the end brings me out all right, what is said against me won't amount to anything. If the end brings me out wrong, ten angels swearing I was right would make no difference."

But, at the same time, it is very helpful to have the angels on your side all the way through; and so we ask for the sympathetic consideration and helpful advice of our members during the coming year, and for the practical support of the whole industry for which we labour.

* This appears on a subsequent page of the "Bulletin."—ED. J.G.L.

Conservation and Apportionment of National Water Sources.

In the House of Commons last Thursday, Mr. Samuel Roberts, the Member for Eccleshall, asked the President of the Local Government Board whether, with a view to conserving, apportioning, or regulating the available water supplies of the country, he would consider the advisability of Parliament setting up a national water authority; or whether, having regard to the importance of the subject, he would appoint a small Committee of water experts to inquire into, and report upon, the necessity of such action being taken. In reply, Mr. Burns said he had a Bill in preparation dealing with this question. Meantime the Local Government Board had been engaged in collecting a large amount of valuable information as to the existing sources of water supply; and he had appointed a geologist on the staff of the Department with particular reference to the subject. The information gained in this way, and also from the researches of the Geological Survey Office, could not, he said, fail to be of service in the consideration of questions such as those referred to by the honourable Member.

The Gas Accumulator Company (United Kingdom), Limited, has been registered with a capital of £60,000, in £1 shares, 30,000 of which are vendors' shares.

DEPRECIATION AND INCOME-TAX.

The Case of Municipal Undertakings.

There has just been issued by the Incorporated Institute of Municipal Treasurers and Accountants a memorandum on depreciation—wear and tear allowances for income-tax purposes on machinery and plant used for gas and tramway undertakings. The Council have carefully considered the scheme for gas undertakings, other than those owned by municipal and other public authorities; and in their judgment, while introducing some new features, it would, if made applicable to municipal undertakings, prove in practice of doubtful advantage to the authorities concerned. The allowances therein provided for, it is pointed out, relate to items of minor outlay only, except as regards gasholders, in which instance it is to be noted the expenditure to be taken account of is very rigidly defined and restricted in the scheme.

The memorandum goes on to say that the Council are of opinion that under the conditions which prevail in the majority of towns, it is preferable that all expenditure on repairs and renewals should be charged and allowed as working expenses as and when incurred, rather than to accept the concession of such limited wear and tear allowances as those above-mentioned, involving as, of course, they would, not only the denial of any allowances for past wear and tear, but also of all future renewal charges.

During recent interviews, it has been pointed out on behalf of the Board of Inland Revenue that the position of statutory companies is essentially different from that of local authorities, in that the undertakings of the former are liable to compulsory acquisition by local authorities at any time, and, if so acquired, any such company would be seriously prejudiced if it had not obtained year by year allowances for wear and tear by way of depreciation, because it would then be unable subsequently to secure the equivalent thereof in the form of deductions for renewal charges as municipalities can, and do.

By virtue of section 12 of the Customs and Inland Revenue Act, 1878, the amount allowed "as representing the diminished value by reason of wear and tear on any machinery or plant . . ." is restricted by the words "during the year;" while under section 26 of the Finance Act, 1907, such allowance becomes cumulative if necessary. But this provision does not, apparently, apply to the actual expenditure on renewals.

The final scheme arranged for gas undertakings other than those owned by public authorities (which was given on p. 830 of the "JOURNAL" for Sept. 24 last) is set out in parallel columns with the municipal scheme; and attention is called to the fact that the proviso in the second paragraph of both schemes permits the expenditure on renewals to become cumulative so as to meet the necessities of the case therein referred to, and is a distinct concession.

The following reference by the "Accountant" to the latest scheme is quoted:

> In practice it is, we think, very safe to assume that no scale of rates that the Income-Tax Authorities could be induced to approve would ever, in fact, be equal to the actual depreciation charge necessary to provide for ultimate renewals. . . . In some districts, allowances are more generous than in others; but upon the whole they are always inadequate, with the result that if the allowance be claimed in respect of the actual cost of renewals undertaken from time to time, the company will certainly benefit in the long run so far as those assets are concerned which are actually renewed eventually.

The memorandum says that the opinion set forth in the last paragraph expresses with accuracy the views of the Council. Many of the largest authorities in the country have for many years adjusted their assessments to income-tax in conformity with the principle thus recommended, and could not at this juncture be expected to approve any less favourable basis of settlement.

After careful deliberation, the Council see no reason to press for any alteration of the original scheme, in so far as it relates to gas undertakings. They have necessarily been influenced by the fact that it has been very widely adopted with general satisfaction, and likewise by the very material consideration that it was at its initiation agreed upon by the several parties thereto as a compromise on the whole question.

THE ORIGINAL SCHEME.

The following is the scheme as set forth for determining the allowances to be granted for wear and tear in respect of the various commercial undertakings of municipal corporations.

Gas and Water Undertakings.

No depreciation to be allowed under any circumstances in respect of any portion of these undertakings.

All expenditure on repair and renewals, but excluding extensions and improvements, to be charged and allowed as working expenses, as and when incurred.

Provided that whenever any exceptional expenditure on *bonâ-fide* renewals is incurred, and full effect cannot be given to its deduction in that year owing to the profits or gains chargeable with income-tax in that year being less than the amount so expended, the balance of the said expenditure, which has not been allowed, shall be carried forward and allowed in the following year or years, as is provided in the case of unallowed depreciation by section 26 (3) of the Finance Act, 1907.

Electric Lighting Undertakings.

Meters, Loose Tools, and Office Furniture

No allowance to be made for depreciation, but annual expenditure for maintenance to be charged as a working expense, as and when incurred.

General.

In all cases where depreciation allowances are granted, a strict account should be kept of the annual expenditure on renewals, including replacements due to obsolescence, and of the amounts

allowed for depreciation and obsolescence, whether under this arrangement or under any arrangement made prior hereto, and a readjustment should be made for the future, if necessary, at the end of every five years, as detailed under tramways permanent way.

Where depreciation allowances are granted, . . . renewals should be carefully distinguished; and if charged against revenue, they should be notified to the Surveyor, in order that they may be added back in arriving at the income-tax liability.

"Written down value" means original prime cost *plus* subsequent additions, less all allowances actually granted by the Revenue in respect of wear and tear.

These proposals are to take effect for the year 1908-09, and for years preceding in cases where claims of depreciation are at the present time awaiting settlement.

The computations necessary for any future adjustment should be duly made, agreed, and recorded each year, whether the accounts for the particular year under review show any assessable income-tax liability or not.

Where, in any cases, allowances for depreciation have been made which are now to be discontinued, and they have not been exhausted by renewals already effected, the amount of the said unexhausted allowances should be determined by agreement between the Surveyor of Taxes and the corporation or company, and deducted from the expenditure on future renewals as and when they are effected.

All cases of dispute should be referred to the Board through the Chief Inspector of Taxes.

Periodical Adjustment.

A strict account should be kept by the corporation and the surveyor of the annual allowances, and of the actual expenditure on repairs and renewals, and at the end of ten or fifteen years —*i.e.*, the second or third revision—or at such time as the general renewal of the track shall have taken place, the amount to be annually allowed should be reconsidered and increased or diminished for succeeding years as the ascertained facts shall show to be necessary, provided that under no circumstances shall the allowances for previous years be re-opened.

All expenditure on extensions and improvements should be excluded from the working expenses for income-tax purposes; and the necessary additional allowance for depreciation on the lines suggested above—*i.e.*, mileage—should be at once allowed on such expenditure, and added to the sum already allowable.

RECORD GAS CONSUMPTION IN BIRMINGHAM.

Some figures which are instructive, as reflecting the general prosperity of trade in Birmingham—and that of the gas undertaking in particular—have been published by the "Daily Post." They indicate that at the present time the consumption of gas for manufacturing and industrial purposes is on an enormous scale. The statistics are reproduced here, as published by our contemporary.

The quarter just ended is usually the busiest in the year; and this time work has been carried on at high pressure right up to Christmas Eve. We have had comparatively little fog to cause an extra demand to be made for artificial light; but nevertheless the resources of the department have been taxed severely. The Gas Department's week closes on Thursday; and during the week ended Dec. 19, the output of gas amounted to the large total of 247 million cubic feet, as compared with 236 million cubic feet in the corresponding week of 1911. On Christmas Day and Boxing Day, the pressure is never abnormally heavy; but during the week ended Dec. 26, the quantity of gas distributed was 209 million cubic feet, as compared with 183 millions in the corresponding week of 1911. Prior to December, the record weekly output was reached in the week ended Jan. 25 last, when the total distribution was 239 million cubic feet. But this record has been beaten twice recently; for in the week ended Dec. 5 the output reached the high figure of 248½ million cubic feet, while the following week the register indicated a consumption of 242 million cubic feet. Thus, while the record output now stands at 248½ million cubic feet for the week ended Dec. 5, the distribution in the week ended Dec. 19 is only 1½ million cubic feet less.

The financial year of the department ends on March 31; and the increase in the consumption of gas from April 1 last compared with the previous year is over 9 per cent., notwithstanding that the year ended March, 1912, was regarded as an abnormally high year in gas distribution. The maximum daily consumption was reached on Nov. 29 (a dark, damp, and somewhat foggy day), when the department distributed in the twenty-four hours no less than 40½ million cubic feet of gas. Prior to that date, the biggest total used was on Jan. 18, 1912, when the consumption was 39 million cubic feet.

A substantial portion of the increased consumption is, no doubt, due to the popularity of gas fires and cookers in the household. The department have issued on the hire-system over 13,000 gas-fires, and have sold many thousands of cookers, all of which contribute in no small degree to the increased demand for gas. But when all is said and done, the principal factor in the increase is the greater demand for gas for manufacturing and industrial purposes; and that is a sure sign of trade prosperity.

Lighting of the City of London.—Within the next few weeks, the Corporation of the City of London will put in hand the work of completely changing the public lighting; and it is expected that when the transformation is accomplished, London will be the best lighted city in the world. The total light will be increased by more than 600,000-candle power, and the expenditure on the arrangements will be reduced by £6800 per annum. The details of the scheme have already been given in the "JOURNAL." It is expected that the work will be completed in the early autumn.

EDINBURGH AND LEITH GAS UNDERTAKING.

Popularizing Gas.

Further evidence of the forward policy that has recently characterized the Edinburgh and Leith Corporations' Gas Commissioners was given at their meeting in Edinburgh on Monday of last week. Lord Provost INCHES presided.

On the motion of Messrs. Robertson and White, a remit was made to the Finance and Law Committee to consider the advisability of appointing a Publicity and Advertising Sub-Committee. Since the financial year of the Commissioners began, on May 16, the number of cookers fixed (less removals) has been 2990, as compared with 387 in 1911. The total number of cookers on hire is now 13,129, compared with 9344.

REPAIRING GAS-COOKERS.

Mr. A. Masterton, the Engineer and Manager, submitted the following report regarding the repair of cookers belonging to consumers:

> With reference to the instructions of the Works' Committee at their meeting on Nov. 18, 1912, to submit a report as to cookers belonging to consumers which we have been asked to repair from time to time, I beg to say that there have not been many instances of this kind; but where they have arisen, and the party was not agreeable to pay for the repairing, we have offered, in order to pacify the consumer, and to act as fairly as possible between the Commissioners and outside traders, to repair the cooker on the understanding that the consumer should pay for all the new parts and other materials required—no charge being made for the labour. Of course, in cases of this nature the consumer can demand a gas-stove from the Commissioners on free loan and with free fitting, and may put his own one aside or otherwise dispose of it; and it is to the interest of the undertaking to avoid, if possible, the extra capital expenditure. However, I shall be glad to have the Committee's ruling on the subject for future guidance.
>
> Another variation of this subject which has cropped up at intervals has been the fixing of consumers' own cookers and other domestic appliances. In such cases, we have informed the parties that a charge would require to be made for the fitting. Will the Commissioners kindly determine if this practice is to continue?
>
> As we are now hiring-out fires, as well as selling them outright, I feel sure the question of maintenance of consumers' own fires will very shortly arise; and I shall now be glad to have the Commissioners' instructions as to how such cases should be dealt with. I may mention that for a few years past we have been giving the consumers' gas-fires a general overhaul at the commencement of the winter season free of charge for labour, but receiving payment for any new materials required.

Mr. Pennell pointed out that various consumers had installed expensive fires and ovens; and if the Commissioners did not maintain these in good order, it was quite open for the consumers to tell them to remove the fittings and put down others. The man who held his own fire or stove was not so well off as the one who had a free stove from the Commissioners. It was eventually agreed to put everyone on the same footing as regards maintenance—that is to say, consumers who own their own fittings will have repairs done free.

THE EXPORT TRADE IN COKE.

Mr. Pennell moved that a monthly return should be provided with regard to the sale of coke. They had made a jump of about 4s. in the price this last year; and it was desirable that they should not act in an ultra-secretive way. Instead of exporting as much coke as possible, they should endeavour to have it disposed of in their own area. Bailie Lindsay, the Convener of the Works Committee, said the argument was that they should endeavour to build up a home trade, and not an export trade. He could assure them that this was the very thing they were doing, and doing to such an extent that for a considerable time they were getting 3s. 6d. per ton more for export than for local consumption. At present, they were obtaining 2s. per ton more for export. How far were they expected to keep the local price below the export? They could export the whole of their coke without any local demand at all; but they did not want to do this, and were giving the local consumers at present an advantage of 2s. per ton. Mr. Pennell contended that they had been refusing orders to renew annual contracts to consumers of coke who had been on their books for long periods of years. He thought it a great pity that they should upset their former arrangements simply because they were offered more for export for the time being.

BRITISH COMMERCIAL GAS ASSOCIATION.

The question of whether the Commission should join the British Commercial Gas Association was remitted back for further consideration in Committee.

BRITISH COALITE COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at River Plate House, E.C.—Mr. J. TODD (the Chairman) presiding.

The SECRETARY (Mr. F. Herbert Smith) having read the notice convening the meeting, the report of the Directors was presented. It showed that the operations of the Company in the twelve months ended Sept. 30 last resulted in a loss of £11,192, mainly due to contracts which matured during the year, and which could not be previously cancelled. The Directors stated that the expenses of the Company should not exceed £500 per annum, inclusive of executive and administrative charges; while the leases on both the Barking and Wednesfield properties bring in sufficient rental to cover all rates, taxes, and upkeep.

FINANCIAL POSITION OF THE COMPANY.

The CHAIRMAN, in moving the adoption of the report and accounts, said that on the debit side of the balance-sheet the first mortgage debentures issued were £75,000—the same figure as before; but, as

explained in a note, a fresh arrangement had been made with the trustees for the first debenture-holders whereby the date for redemption had been extended to July 1, 1915. It had been necessary to redeem £10,000 of the debentures, which latter operation had been effected by obtaining a loan against the ordinary and deferred shares which they held in Coalite, Limited. Arrangements had been made to redeem a further sum of £5000 of first debentures, which they were enabled to do by a sale of part of their Wednesfield property. Creditors for loans and interest stood at £10,335, against £8332; the increase being accounted for by further advances by Coalite, Limited, for assisting to complete the batteries at Barking. The Eticoal Syndicate appeared as creditors for £9838 in respect of expenditure provided by them under the agreement for completing the fire-clay batteries and for operating expenses in the last eight months of the financial year. On the credit side, the estimated value of buildings and plant at Barking was £1000, against £5000 last year. At Wednesfield, the estimated value was £10,000, against £14,000; the reduction of £4000 being represented by plant sold and a transfer to suspense account. The value of the shares in Coalite, Limited, was taken at £10,000, against £3125 last year. The present value was as certified by the Company's brokers—being practically to-day's prices; and the increase of £6875 was deducted from the item of £172,958 held-up in last year's balance-sheet. The items added to the suspense account were transfers deducted from the Barking, Wednesfield, and stock accounts, amounting to £7933. General expenditure was increased by the debit balance on the year's operations shown by the trading account, amounting to £11,192. Practically the whole of this debit had accrued at the date of the meeting in March last, when he stated that, after the close of the then current financial year (Sept. 30), the Directors expected the expenses of administration would not exceed £500 per annum. This had been realized, as the present cost of office accommodation, Secretary, Engineer, and Auditors was below this figure. The remark he made at the last meeting, that neither the Directors nor the Managing Director were drawing any fees and were paying their own travelling expenses, still held good.

STATEMENT BY THE MANAGING-DIRECTOR.

The MANAGING-DIRECTOR (Mr. Herman Clarke), in seconding the motion, first called attention to the improvement in the position of the debentures, and pointed out that, if anything should occur to require their redemption before July 1, 1915, the Company had sufficient assets to protect the shareholders. Turning to technical matters, the speaker said the figures of production were being certified by a firm of accountants and by a well-known gas engineer: and these certificates would be laid before the shareholders a little later in the year. The Eticoal Syndicate had satisfied itself or its Directors of the value of the process, and had inserted advertisements in some of the technical journals offering to erect plants on a guaranteed result basis. It was the practice, in creating coke-ovens, to enter into contracts with the collieries to erect an oven guaranteeing certain results as to production. The Eticoal Syndicate were prepared to do the same thing as regarded coalite; and they were in negotiation with a number of collieries for the erection of plants. It had been decided for the present, at least, owing to the peculiar condition of the coal trade in Great Britain, that it was better to erect the plants at the collieries rather than in London; distributing the coalite into the best markets which could be reached from the immediate vicinity of its production—taking the tar, if necessary, to a central distillery, or, where the plant was large enough, distilling at the colliery itself. Negotiations were now proceeding, and should be completed within a reasonably short length of time, for plants representing an output of between 500 and 1000 tons of coalite a day. Without wishing to appear too optimistic, he thought that in the most adverse conditions these plants should show a profit, exclusive of any sale of gas and of tar distillation, of 4s. per ton of coal carbonized; and it was a simple matter to calculate what this return would mean. He thought shareholders could safely make up their minds that the Company had turned the corner in the situation, and that it was going to occupy a position in the industrial world on the same plane as coke-oven and gas companies, if not better. They had a commercial proposition which, he believed, would grow and would be profitable; and he was convinced that within a reasonable time the shareholders of the Company would get a dividend. Certain arrangements were now being considered by the Directors for a financial reconstruction, which would, in their opinion, make the shares considerably more valuable than the present market price. Mr. Clarke added, in answer to a question, that the Company had entered into arrangements with the Eticoal Syndicate, whereby they were interested to the extent of 40 per cent. in the net profits of the concern. The Syndicate had the privilege of purchasing the assets of the Company for its debts, secured and unsecured, and the right to operate under the patents; but this was not a particularly valuable option at the moment, because the assets were not worth more than the price as they stood, though they might become more valuable.

The motion was carried unanimously, and the proceedings closed.

WEST BROMWICH GAS UNDERTAKING.

A Vertical-Retort Scheme.

Last Thursday, Mr. T. C. Ekin, an Inspector of the Local Government Board, held an inquiry at West Bromwich regarding the application of the Corporation for sanction to borrow £14,000 for the installation of vertical retorts at the gas-works.

The Gas Engineer (Mr. Harold E. Copp) gave details of the scheme, and explained that it was proposed to replace the No. 4 bench of retorts, which was built in 1891, with three settings of vertical retorts constructed on the Woodall-Duckham system, and arranged so that two more settings might be added as necessity arose. The vertical-retort settings would be placed at right angles to the direction of the existing settings. The first three vertical-retort settings would be capable of producing 750,000 cubic feet per day; and the completed unit of five settings would produce 1,250,000 cubic feet per day, on approximately the same ground space as that now occupied by the four settings of horizontals, capable of producing 422,000 cubic feet per day. He mentioned, in reply to the Inspector, that they ceased to make water gas in April last. They requisitioned water gas during the coal strike; and when their oil contracts expired, they were unable to make fresh contracts that were sufficiently favourable to enable them to continue to manufacture it.

The Inspector said this was not the first time he had found that the high price of oil had stopped the manufacture of water gas.

The Borough Treasurer (Mr. E. Kirk) explained that, under the Gas Act, there were two unexercised sanctions amounting to £2650; but these they wished the Board to cancel, and to include in the new sanction. They asked for twelve years as the period for the repayment of the loan.

No opposition was offered; and at the close of the inquiry the Inspector visited the gas-works.

NELSON GAS WORKERS AND THEIR WAGES.

Dictating Terms to the Gas Committee.

For some time the men employed at the Nelson Corporation Gas-Works have been agitating for an advance in wages for practically all grades, numbering about 140 at the two stations—Nelson and Brierfield. These demands, which are receiving attention by the Gas Committee, are as follows: (1) All employees in the Gas Department to be paid time and-a-quarter for the first two hours' overtime; time-and-a-half up to 10 o'clock; double time from 10 onwards; and double time for Sundays. (2) All fitters, including stove fitters, to be paid a minimum wage of 34s. 9d. per week of 49½ hours. (3) All labourers' wages to be advanced 15 per cent. (4) All employees in the Gas Department to be conceded 7 days' holiday each year with pay. (5) All stokers employed at Brierfield to receive 10 per cent. advance in wages. (6) That a foreman, whose name was given, be removed from his present position, and not be given a position which will enable him to exercise any authority over any workmen. (7) That the notice posted at the works gate by the Labour Exchange be removed. (8) That one additional slot-meter inspector be appointed. (9) That all pipe jumpers at Brierfield be granted 6d. per shift advance.

In the course of an interview, Mr. Bryan Chapman, one of the men's leaders, said that they were only asking, in regard to overtime rates, the same scale that obtained in other departments of the Corporation. He added that the men were determined to enforce their demands, and, if necessary, to strike work for the purpose.

On Saturday, Mr. A. Morton Fyfle, the Gas Manager, stated that the Committee had received a communication from the Gas Workers' Union officials, to the effect that they had forbidden a strike of the men pending negotiations.

BELFAST GAS-WORKS EXTENSION.

In the course of a review of Belfast trade and commerce during the year 1912, the local "News-Letter" makes appropriate and complimentary reference to the prosperous gas undertaking, and includes some particulars with regard to the extension scheme.

It is recalled that, after negotiations had been entered into for a new site, Mr. James D. Smith (who succeeded the late Mr. Sharpe as Engineer and Manager of the works) was asked to prepare a report regarding the possibility of carrying out a scheme which would enable the Corporation to execute extensions and improvements at the existing works. Mr. Smith recommended that the works should be remodelled and new plant erected. He proposed to instal vertical instead of horizontal retorts, to erect a new gasholder, and to bring the other plant up-to-date; the work to be done in sections. His proposals were adopted by the City Council, and steps were shortly afterwards taken to put them into effect. The scheme was estimated to involve an outlay of £600,000; and it was resolved to divide it into four sections—the first to cost about £250,000. During the year just closed, marked progress has been made with the work. A spiral-guided gasholder has been erected in place of one of the old holders, by Messrs. Robert Dempster and Sons, of Elland; and West's Gas Improvement Company, of Manchester, have installed vertical retorts capable of producing 2½ million cubic feet of gas per 24 hours. The spiral-guided holder has a storage capacity of 3 million cubic feet, as compared with a capacity of 1½ million cubic feet afforded by the holder which it has supplanted. It is now in use, and has proved exceedingly satisfactory. The contract for the new vertical retorts amounted to £38,720, and that for the spiral-guided gasholder to £21,290. For the purpose of the contemplated extensions, the Corporation recently obtained parliamentary powers for the acquisition of the old abattoir site, and other lands adjoining, for the erection of new works and for the manufacture and storage of gas and residual products; and by this means they have made provision which it is believed will enable them to deal with the demands for some years to come. The coke is now being handled by machinery, instead of being wheeled by stokers, as was formerly the case; a plant having been installed to facilitate its removal from the retort-house.

The maximum producing capacity of the plant has been increased from 12,140,000 to 14,640,000 cubic feet in 24 hours, as a result of the installation of the new retorts. The quantity produced in the 24 hours at present is 11,772,000 cubic feet; and with storage of 7,000,000 cubic feet, the maximum day's output has been 12,608,000 cubic feet. When the new scheme is completed, the producing power of the works per day will be 22,500,000 cubic feet.

A feature of the past year was a great demand for copper coins, attributed to various causes, among them being the increasing use of penny-in-the-slot gas-meters. The bronze pieces struck at the Mint last year numbered 77·1 millions, compared with 40·8 millions in 1911—an increase of 36·3 millions.

PRICE OF GAS AT ROTHERHAM.

Some Comparisons.

An opportunity was afforded Alderman Gummer, the Chairman of the Rotherham Gas Committee, of making some comparisons, at last week's meeting of the Town Council, of the considerations affecting the gas undertakings there and in Sheffield. This opportunity was given by Mr. Habershon, who, in view of the recent increased price of gas to manufacturers, invited an explanation on the following point: "How is it that gas in Rotherham is so much more than in Sheffield, having regard to the fact that Rotherham is in the heart of the coal-field, has an up-to-date plant, and is controlled by a Committee who receive no payment for their services? The Sheffield Gas Company have to meet Directors' fees, are farther from the coalfield, and are still able to pay 10 per cent. dividend, and put a good sum annually to the reserve fund."

Alderman Gummer said he was personally obliged to Mr. Habershon for asking the question, because there had been a good deal of comment in the town, particularly during the November elections. He thought the answer really lay in the size of the city of Sheffield as compared with the town of Rotherham. In order that a sufficient answer might be given, he had been to the trouble to get out some particulars. He found that in Sheffield they had nearly 95,000 consumers, against 16,000 consumers in Rotherham; and the sale of gas in Sheffield was 4000 million cubic feet per annum, against 283 millions in Rotherham. They would see that Sheffield sold fourteen times more gas than Rotherham, and yet they had only six times the number of consumers. It naturally followed that, having proportionately a smaller number of consumers, these consumers took their gas in much larger quantities than was the case in Rotherham. The consumption in Sheffield averaged 40,000 cubic feet per consumer, as against 17,000 cubic feet per consumer in Rotherham—less than one-half that of the city. The distribution charges, the cost of mains, leakages, and other expenses, were very much less when they had a large consumption. Taking mains alone, in Sheffield the cubic feet per mile of mains was 6655, against 3815 feet per mile in Rotherham. The geographical position of Rotherham was very much worse than that of Sheffield. Rotherham had subsidences caused by coal mines, while Sheffield had little or none at all. Rotherham's leakage was 9 per cent., whereas in Sheffield it was ouly 2½ per cent. Sheffield had also the better market for its residuals; the industries taking them up more readily. Then, again, Sheffield did not give any public lighting, or contribute anything to the rates, as was done in Rotherham. Sheffield only paid 1 $\frac{5}{16}$d., against Rotherham's 3¾d. for rates and taxes per 1000 cubic feet sold. Taking interest and capital and sinking fund, these cost Rotherham 8d. per 1000 cubic feet; whereas in Sheffield the Company's 10 per cent. only cost 5d. per 1000 cubic feet. Summarized, it meant that Rotherham's disadvantages were caused by leakage, which was equal to a reduction of 3d. per 1000 cubic feet in price over Sheffield; taxes, 2½d. more; public lighting, 2d.; contribution to rates, 3d.; difference on Sheffield's charge of 10 per cent. on capital and Rotherham's, 3d.—total, 1s. 1½d. per 1000 cubic feet. Rotherham was therefore actually near the Sheffield price. He thought this was rather a credit to the Gas Engineer (Mr. J. S. Naylor). If the Gas Committee had had the money handed over for the relief of the rates, it could have been devoted to the capital account, and they would have been able to reduce the price 1s. per 1000 cubic feet. The fact of the matter was that they could not eat their cake and have it.

INCREASED USE OF GAS-FIRES IN LONDON.

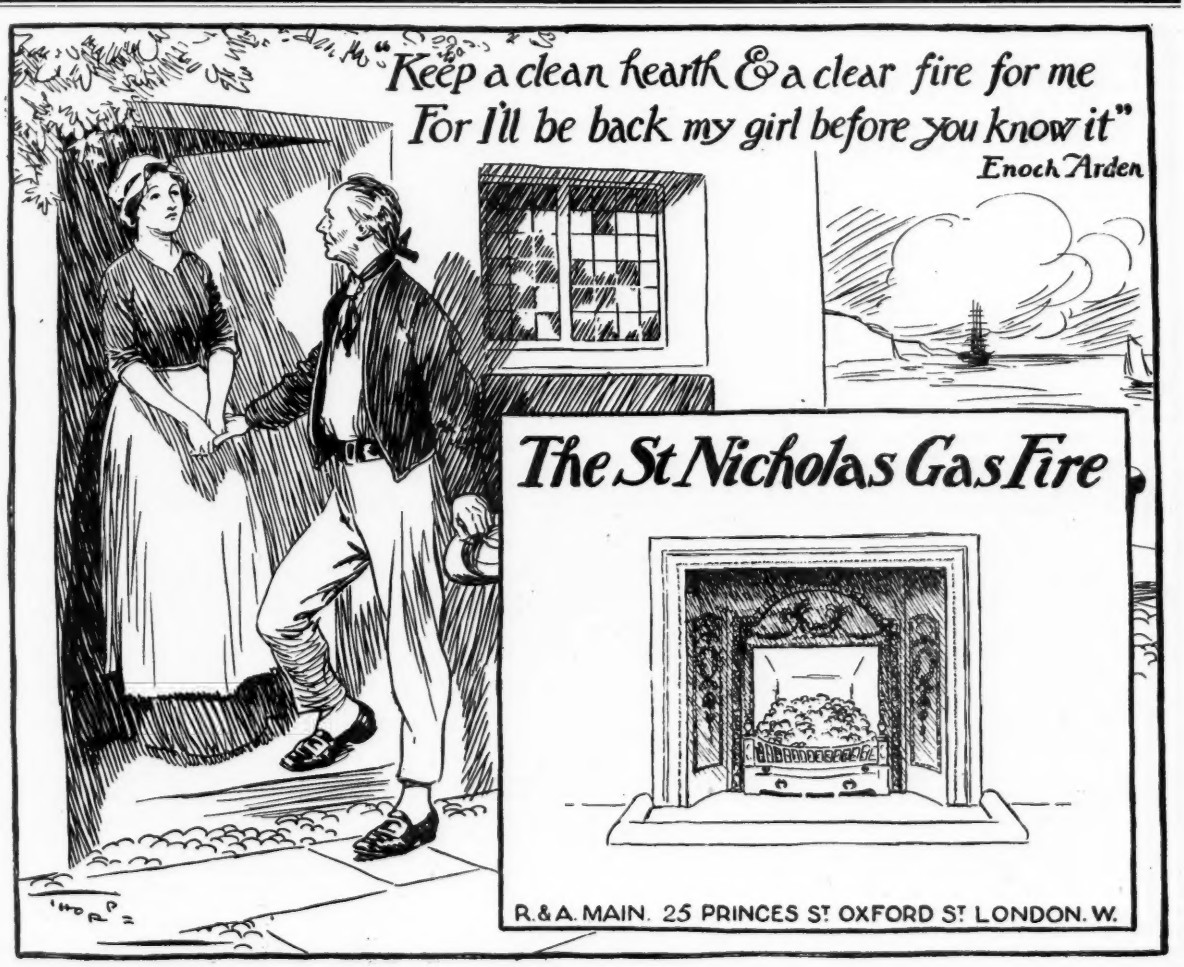
Some Remarkable Figures.

The "Evening News" last Friday contained an article by Mr. W. G. Faulkner, giving the results of some inquiries he has made in regard to the increased use of gas-fires in London. He was prompted to do this by the remark of a coal merchant, who attributed what he called a "glut" of house coal in the Metropolis partly to the extension of gas-fires. The following are some extracts from the communication:

In making my inquiries, I discovered one significant fact. This was that one Company—the Gaslight and Coke Company—had among their consumers 2500 doctors who had gas-fires installed in their houses, some as many as ten or a dozen; that 1500 of these doctors had become users of gas-fires during the past three years; and that not one had ever given them up. A West-end doctor said: "The use of gas-fires in bedrooms has cost me a fortune in diminished fees." In nine months, 80,000 gas heating and cooking stoves have been added to the number already in existence in London houses. The increase in gas-fires during the past six months is 25 per cent. above the number installed during the same period last year, while the gas heaters installed have doubled in number.

Since the coal strike—in fact, since June last—the South Metropolitan Gas Company have fixed upwards of 44,000 gas heating and cooking appliances; being an increase of 14,000 over the same period of 1911. Gas-fires for warming rooms alone show an increase of 8000 on the period. Another system—that of selling 28 lb. bags of coke—has had much to do with the decline of smoke in South London, for more than a million bags were sold to poor people during the past year.

Household fires in London are generally lighted for about eight months out of the twelve. It is not unfair to assume that a ton of coal is consumed, on the average, during the eight months, in each of the fires regularly lighted. There are now 1,574,000 gas-fires in London in place of coal-fires, and these mean not merely that London burns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Enoch Arden
The St Nicholas Gas Fire
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1½ million tons of coal less every year than it was, but that the smoke from a million and a half chimneys has been stopped.

Gas Conquers the Fog Fiend.

Coal fogs are gradually losing their power over Londoners. In the period 1883-92, fog gripped London on an average for thirty days a year. Then came the era of the gas-fire. In all London there were in 1892 only 46,000 gas-fires. Between 1893 and 1901, half-a-million of these fires were put into the houses of London, and the fog fiend's power declined by ten days a year. In the next period—1902-11—nearly a million gas-fires were added; and the fog held London in its grip for only ten days a year on the average. It would, of course, be absurd to place these improved conditions wholly to the credit of gas-fires, since there has not only been better stoking in great works, but a vigorous prosecution of owners of premises which emit black smoke. In the main, the millions of domestic fires of London are responsible for London's heavy fogs; and therefore one is justified in saying that to the great increase in the use of gas-fires we largely owe the extraordinary decrease in the frequency of the fog.

Gas in the Homes of All Classes.

Pursuing his inquiries, Mr. Faulkner found that in many parts of London, especially in the well-to-do districts, the house where no coal was used was becoming quite a common thing. Many doctors in the Harley Street area have as many as nine and ten gas-fires in their houses; but the record is reached by a consumer in the Gaslight and Coke Company's district. He has 44 gas-fires in his house.

But the gas-fire is not only making great headway in the well-to-do districts of London. The Lea Bridge Gas Company report a "phenomenal increase" in Walthamstow, which is a working-class district where the slot-meters are largely used. In Hornsey, 633 gas-fires and 1271 gas-cookers were put in during the past year; the Wandsworth Company put in 600 gas-fires during the autumn; and the Tottenham and Edmonton Company, 1838 during the past two months.

BATH CORPORATION AND ELECTRIC LIGHTING.

Local Government Board Inquiry—Opposition by the Gas Company.

Last Wednesday, Mr. T. C. Ekin, M.Inst. C.E., conducted an inquiry at the Guildhall, Bath, into an application to the Local Government Board by the Corporation for authority to borrow £8000 for the extension of the electric light undertaking.

The Town Clerk (Mr. F. D. Wardle) represented the Corporation; Mr. Vesey Knox, K.C., and Mr. B. R. Vachell (instructed by Mr. C. Y. Petgrave) appeared on behalf of the Bath Gas Company, who opposed the application. In attendance were the Company's Engineer and Manager (Mr. C. Stafford Ellery, Assoc.M.Inst.C.E.) and Secretary (Mr. H. Shepherd).

The Town Clerk, at the outset, stated that the capital sanctioned up to last year was £178,883, of which £170,539 had been expended; leaving a balance of £8344.

Case for the Corporation.

Alderman *Hatt*, the Chairman of the Electric Lighting Committee, was the first witness in support of the application. In answer to the Town Clerk, he said the Committee were satisfied that the proposed expenditure was necessary and desirable; and there was no opposition to it in the Council. The first application was for £3000; and subsequently they asked for a further £5000. The former was for a definite extension to be carried out; the latter would be used not only for extensions within the previous area, but also in an enlarged one.

In reply to Mr. Vesey Knox, witness said they would have to work under the Duke of Northumberland's clause in their Extension Order until 1915, when they would have to revise their prices. The £5000 had already been spent, and (speaking from memory) largely on the old area.

In answer to a question put to the witness,

The Town Clerk said the number of houses in the old city was 10,614, and with the extended area 15,614.

Mr. Knox: So that, roughly speaking, one house in every 16 is supplied, and it costs £170,000 to give a supply to 947 consumers. It costs about £180 to give a supply to every consumer in the city.

Witness, in reply to further questions, said as far as possible the existing lamp pillars would be used. Their revenue would be £2 10s. per lamp per annum. This included current, cleaning, maintenance, and repair. The lamps were 60-candle power. The charge per unit in the city was very low as compared with other places.

Mr. Vesey Knox agreed that taking the charge as a whole it was low; but he put it to the witness that in the old streets, where electricity was substituted for gas, they were charging a high rate, whereas in the new streets, where they tried to show the Surveying Committee to advantage, they were charging an unduly low rate. He contended that the electric lighting undertaking, when in competition, tendered at half the cost.

Witness said he disputed this. He submitted that the undertaking made a profit on the sale of current for public lighting of more than 1d. per unit. They had to remember that the public lighting load was to all intents and purposes a day load. In answer to further questions, he said he recognized that the Gas Company were the largest ratepayers in the city, paying £3250 in rates and taxes, whereas the electric lighting undertaking was assessed at £1500 a year net. It was acquired in 1898; and the Corporation paid £26,000 for it. Of the original loan, £10,000 remained unpaid. Users of current for motive power were entitled to 10 per cent. off the charge for lighting.

Mr. Vesey Knox quoted figures of sales for the past few years, and contended that the capital invested did not allow of the supply of

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power at cheap rates without a loss. He gave figures from other towns as to the profit made on similar undertakings, and said it was a remarkable fact that in almost all there was a profit—Torquay being the only other place where there was a loss. He asked whether, in view of the fact that Bath was getting less than the average price for its electricity for private supply, it did not suggest that it was because the Committee had taken over a certain part of their load factor at unremunerative prices.

Witness said he did not admit this. He stated that the load factor in 1897 was 11·4, and in 1908 it was practically the same.

Mr. *F. Teague*, the City Electrical Engineer, gave details of the work to be executed, first with regard to the Weston district, where high and low tension cables would be laid down. He also supplied particulars as to the £5000 loan, and admitted that much would not be left for extension.

The TOWN CLERK said the Council would have to apply for a further loan when they knew precisely what their requirements were.

Witness further pointed out that there had been an increase in the connections and the number of units supplied; the total for the nine months showing an increase of 150,000 units, while the consumers showed a corresponding advance.

In cross-examination by Mr. VESEY KNOX, witness stated that, under their estimate, the public lighting at Weston would, after allowing for the cost of renewals, &c., yield rather more than 1d. per unit for the current supplied, and the works cost was 1·41d. On Counsel remarking that this was "not a very fat thing," witness said it depended upon the point of view. He regarded the public lighting as the most satisfactory form of revenue. Weston was a residential neighbourhood; but there was more than one industry there.

Mr. VESEY KNOX: You recognize that the Gas Company are supplying 8000 slot-meter consumers and 8000 ordinary consumers—a great deal more than you are doing—and supplying them cheaply. To the extent that anything is taken out of the rates and charged upon the gas undertaking, that money is paid by the consumers, for it tends to keep the prices high?

Witness: The consumers cannot complain. There would be no harm in putting a few pence on.

That is the view I should expect an electrical engineer to take. There would not be any harm in putting on a few pence on to the price of gas and make 16,000 people pay a little more in order that you might supply cheaper electricity. Every consumer of gas within this city has had the benefit indirectly of the competition between the two light-supply undertakings. If there had been no electricity undertaking, possibly the Gas Company would not have troubled to improve their supply.

Your view is that your undertaking should be subsidized by the rates?—The general ratepayers have been getting cheap gas for years as the result of the competition.

You know that when the Company have paid the maximum dividends, they must use the profits to reduce the prices, and it would be the consumers who would suffer?—I do not think they have suffered. I think we have helped in giving them cheap gas.

In further cross-examination, witness said he had no knowledge of the fact that the Gas Company offered to provide lamps in the centre of the city at a cheaper rate than did the Electric Lighting Committee. The Corporation, he submitted, treated them no better than they did the Gas Company.

Mr. VESEY KNOX: That is all we want—to tender on a competitive basis. If this was so, we should have no cause for complaint. I put it to you that the Committee have constantly accepted your tenders when they have been very much over the gas tender?

Witness said he was not aware of it.

THE GAS COMPANY'S OBJECTIONS.

Mr. VESEY KNOX said he did not purpose calling any witnesses; and he proceeded to address the Inspector on behalf of the Gas Company. He submitted that they were the largest ratepayers in Bath, and represented the mass of small consumers; and he pointed out that the whole of the benefit of any saving they could make went to the consumers. They had brought down the price of gas to a figure which, for a place like Bath, was extremely favourable; and the effect of putting something on the rates in the way proposed would prevent them from further lowering the price as quickly as they might do. He protested against the theory that, because the electric light undertaking belonged to the ratepayers, they were entitled, through their representatives, to raise what loans they pleased, or grant to it what subsidy they liked. He submitted that this was not good policy. He ventured to contend that, though it was quite legitimate that, during the early years of the electric light undertaking, something should be given by the ratepayers in order to create a property, when once it had been established and should be on a firm basis it ought to be made to pay its way. If it did not, it meant that the 16,000 small consumers were paying in order that 1000 richer people might have a luxury at less than its cost. This was economically wrong. It was desirable that the Corporation should consider the whole position of the electric light undertaking, in order to prepare for what they would be bound to do in 1915. They should ask themselves whether any extension was really justifiable, and make up their minds that they had to comply with the law, and cease to subsist on the poorer classes for the benefit of the middle and the upper classes who used the electric light. The learned Counsel dealt in detail with the financial position of the undertaking, and submitted that the Corporation had not shown the same care with the ratepayers' money as the Directors of a company would have done with that of the shareholders, or a private individual with his own. Counsel concluded an impressive address by assuring the Inspector that the Gas Company did not in any sense object to fair competition. On the contrary, if the electric light undertaking was conducted on a proper basis, there was no possible reason why gas and electricity should not help one another. But what the Company did feel, however, was that they, as the largest ratepayers in the city,

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should have to bear an annual impost in the way of subsidy of a competing undertaking which had been in existence so long that it ought now to be on a self-supporting basis. He argued that the Corporation should not be allowed to spend this money. What the Company suggested was that there was no evidence before the Inspector that would justify the expenditure of more money than was necessary for laying mains in the compulsory area, and that, as a matter of principle, no money ought to be spent upon an extension where, as in this case, there had been no estimate to show that there would be a profit. The Company did not want in any way to prevent fair competition; but they did think that, from the point of view of the ratepayers, this matter should be very carefully reconsidered.

THE TOWN CLERK'S REPLY.

The TOWN CLERK, in reply, said he had no hesitation in stating that if the Corporation had time allowed them to meet each of the points addressed to the Inspector, they would be able to satisfy him with regard to the large majority of the suggestions which had been made. He must ask him, therefore, if, as a result of preparing a report, he came to the conclusion that some more detailed explanation was required from the Corporation on any point, he should invite them to give it to the Board. Having replied in detail to some of the points raised by Mr. Vesey Knox, the Town Clerk concluded by expressing the hope that the Inspector would represent to the Board that the Bath electric lighting undertaking suffered from certain serious disadvantages, and was entitled to sympathy. The Gas Company looked too closely at the small proportion they had to pay in the way of rates, and ignored the fact that they were also shareholders in the large capital sum which was being accumulated. He submitted that they should take the thick with the thin, and not stand in the way of the normal and proper development of the undertaking.

The inquiry then closed.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Aberdeen.—The supply of water from the Dee was the subject of a communication to the Aberdeen Water Committee from Dr. Houston, the Director of Water Examination to the Metropolitan Water Board, London. He considered that, to render the water from the river entirely free from bacilli, about 2 parts of lime should be added to every 100,000 parts of water; and he advised the carrying out of experiments to prove this, as, if satisfactory, it would be a cheap and easy way of dealing with the water. The Committee arranged that Dr. Matthew Hay, their Medical Officer of Health, should make the necessary chemical and bacteriological examinations during a period of two weeks. The advantage of the method of treatment is that, if successful, no filtration will be necessary, which would save not only capital, but also running expenses.

Cambuslang.—The reservoirs of Cambuslang, at Turnlaw, having a capacity of 60 million gallons, have become so full, owing to the continuous rainfall, that the water is overflowing the embankments for the first time since the reservoirs were constructed.

Dunoon.—A scheme of extension has been decided upon for the Dunoon Gas-Works, which, while not being exactly a reconstruction of the plant, will form such an addition to the manufacturing and storing capacity as will assist greatly in the increased supply of gas. The Town Council have sanctioned the erection of a 250,000 cubic feet capacity gasholder, on the spiral-guided system. The contract for the work has been placed with Messrs. Henry Balfour and Co.; and the cost, including foundations, is to be £4160. In addition to the above work, Mr. David Robertson, the Engineer, has been instructed to invite offers for an installation of vertical retorts with retort-house complete. When the extensions above referred to are finished, it is expected that the manufacture of gas will be carried on to much greater advantage than is being done at present, with the shortage in holder capacity and the old settings of retorts. The undertaking now supplies the lighting of both Sandback and Innellan. The make of gas has increased from 36½ millions in 1908 to 43 millions in 1912.

Fraserburgh.—In connection with the appointment of Gas Manager at Fraserburgh, the short leet consisted of Mr. Archibald Muir, of Greenock, Mr. Edwin Allison, of Airdrie, in addition to Mr. M. D. Campbell, who was appointed. Fraserburgh is increasing rapidly in size. The make of gas is now nearly 30 million cubic feet per annum, and the prospects for the coming year are even brighter.

Gourock.—It has been decided by the Gourock Town Council to erect a new gasholder costing about £5000, providing the sanction of the Sheriff can be obtained.

Lochmaddy.—What is probably the most unique shortage of water is now being experienced at Lochmaddy, in the outer Hebrides, and this despite abnormal rainfall since October. Lochmaddy has been a special water district for some years; having drawn its supply from a loch and a dam about three miles away on a high hill called Lee. Since the beginning of a week ago, the supply has been curtailed, and now it is entirely exhausted.

Penicuik.—The Penicuik Gas Company have decided to supply gas grillers and boiling burners free of charge to their consumers, and have fitted up a number of houses, occupied by tenants of the Shotts Iron Company and of the late Mr. John Dennis, with gas-fittings and prepayment meters. They are also installing a booster fan for increasing the pressures at the Glencorse Barracks and the Dalmore Paper Mill area, and contemplate extending this main to Milton Bridge.

Whitehills.—The water supply to Whitehills, Banffshire, which has caused much local controversy, has been inquired into by Mr. Walter Smith, the Engineer to the Local Government Board for Scotland. The question is as to whether the supply should be from springs at Dallachy and Warylip or a scheme of taking water from the Watts

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Bog; the latter causing much opposition. The water from the springs is to be tested by a Sub-Committee and by the engineers and other officials of the County Authorities.

In another part of the "JOURNAL" (p. 20) will be found a review of "Gas Affairs in Scotland" during the past year.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Jan.* 4.

For the first day or two of the week the tone was rather quiet, but with the advent of the New Year there was a revival of the good demand, and the market again developed a hardening tendency. The direct inquiry has only been moderate; but middlemen have competed keenly for the available supplies. The closing quotations are £14 6s. 3d. per ton f.o.b. Hull, £14 7s. 6d. per ton f.o.b. Liverpool, and £14 8s. 9d. per ton f.o.b. Leith. The forward position has been somewhat neglected, and no first-hand transactions have been reported; but producers continue very firm in their views, and are mostly holding for £14 15s. per ton, f.o.b. at the ports, over the first half of the year.

Nitrate of Soda.

This market is a shade easier, and values have receded to 11s. 6d. per cwt. for ordinary quality and 11s. 7½d. for refined, on spot.

LONDON, *Jan.* 6.

Tar Products.

The markets for tar products remain fairly steady. Pitch maintains its price; and there has been a slight improvement at some ports. Benzols are quiet, though there has been no further lowering in price. Solvent naphtha does not appear to be quite so firm; and there is more of this article offering for near delivery. Heavy naphthas are in fair demand. Creosote is exceedingly firm, and well maintains its price. The inquiry is good for both prompt and forward delivery. Crude carbolic does not seem to be quite so firm; and consumers report that they are being offered for January-June delivery at lower figures.

The average values during the week were: Tar, 28s. 3d. to 32s. 3d. Pitch, London, 45s. to 46s.; east coast, 44s. 6d. to 45s. 6d.; west coast, Clyde, 44s. 6d. to 45s.; Manchester, 42s. to 43s.; Liverpool, 43s. to 44s. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 9½d. to 10d.; 50-90 per cent., naked, London, 10½d. to 11d.; North, 10d. to 10½d. Toluol, naked, London, 10½d. to 11d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 5½d. to 5¾d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d.; North, 1s. 1d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10½d. to 11d. f.o.b. Creosote, in bulk, London, 3½d. to 3¼d.; North, 3d. to 3¼d. Heavy oils, in bulk, 3⅜d. to 3½d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 2s. 1d. to 2s. 2d. Naphthalene, £5 to £9; salts, 45s. to 50s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market is still very steady, and prices have improved slightly for prompt and forward delivery over the next few months. Actual Beckton is only quoted for January-April delivery at £14. In Leith, the quotation is £14 10s. for prompt and £14 15s. for forward; Liverpool, £14 8s. 9d. to £14 10s.; Hull, £14 7s. 6d.; Middlesbrough, £14 8s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

The work at the northern collieries for the first few days after the holidays has been rather limited and the output is consequently small so far. The demand is full. For steam coals, best Northumbrians are from 15s. 3d. to 15s. 6d. per ton f.o.b.; second-class steams are 14s. 6d. to 15s.; and steam smalls are scarce at about 11s. to 12s. In the gas coal trade, the demand is very full. Best Durham gas coal is now quoted from 16s. to 16s. 3d. per ton f.o.b; and second-class is from 15s. 3d. to 15s. 9d. "Wear" specials are about 16s. 6d. per ton, and are scarce. The long contracts take up the bulk of the production of gas coals; but in a day or two a normal output should be reached, and the deliveries will then be adequate. In the meantime, one of the large gas coal contracts for a Scandinavian port is in the market; tenders being due within a week. The quantity is about 200,000 tons for delivery at Copenhagen before the end of this year. As freights are easier than they were, and the delivery begins after the chief demand of this winter has been met, there is much interest felt as to what the tenders may be. Other gas coal contracts are expected to follow. Coke is firm. Gas coke is in full supply—good makes being 21s. 6d. to 22s. per ton, f.o.b. in the Tyne.

Scotch Coal Trade.

On account of the New Year holidays, and the consequent closing-down of the pits for several days, business in the Scotch coal trade was practically suspended during the past week.

Electric Box Explosions in Belfast.—In a report of the Belfast Corporation Gas Committee recently presented, it was stated that an explosion in an electric box in Rosemary Street on the 25th of November, caused by the gas service-pipe having been fused by contact with an electric cable, an escape of gas resulting, was the twelfth or thirteenth accident of a like character which had occurred during the past few years.

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AND ORDINARY METERS.

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Lighting of Leeds Market Hall.

A resolution of the Markets Committee that the Market Hall should be lighted with high-pressure gas-lamps similar to those in the Market Square, and authorizing the Chairman and Deputy-Chairman to make the necessary arrangements, was opposed at last week's meeting of the City Council by Mr. Watson, who moved an amendment referring back the resolution, which he argued was a violation of the orders of the Council, as particulars of the cost were not set out. It had not, he said, been proved that the high-pressure gas-lamps were superior to metal filament lights. The Gas Committee were trying to keep back the installation of electricity. Mr. Armitage, in seconding the amendment, remarked that last year, when he was the Chairman of the Electricity Sub-Committee, the question of high-pressure gas lighting as against electric lighting in the markets was discussed; and the information they could obtain at the time was very incomplete, and to his mind very unsatisfactory. They easily secured information as to the entire cost of electric lighting; but the only price they could get in regard to high-pressure gas was the price the Gas Department quoted, and not what the cost would be to the Corporation. Alderman Wilson suggested that the Chairman of the Markets Committee should take the resolution back for a month. He did not think the lighting should be interfered with in the winter time. In his opinion, it was not by any means proved that high-pressure gas lighting was the cheapest system or the best. Alderman Kinder also said he should like the Chairman to take the matter back. It was the obvious intention of the Committee, if the resolution was passed, to proceed with the work at once. This was a revenue charge; and there was no provision for it in the estimates. If Committees had not these sums in their estimates, they must not spend them until the next year. After Mr. Foster had stated that he did not think the matter was adequately discussed in the Markets Committee, the Chairman of the Committee agreed to take the resolution back.

Pushing Gas Sales at Rochdale.

At last Thursday's meeting of the Rochdale Town Council, Mr. Walker, the Chairman of the Gas Committee, in moving the confirmation of the minutes, had something to say about the systematic efforts now being made in different parts of the country to increase the sale of gas. Those connected with municipal and private gas undertakings in this country were, he said, convinced that there was a large opening for a greatly increased output of gas for heating, cooking, and industrial purposes; and a simultaneous effort was being made by almost all corporations and companies to push the sale with this end in view—it being recognized that the result would not only be helpful from a financial standpoint to the gas undertakings, but of great benefit to the community generally, by a very substantial lessening of the smoke nuisance and increased comfort in the homes of the people. His Committee, falling into line, recommended an extension of the present system of hire of gas-cookers to gas fires, radiators, and other heating appliances. While they could not see their way to cease charging a hiring fee, the Committee would in the future fix them free. The Committee further recommended that the meter hire charged for purposes other than lighting should be abolished. With improvements in the design and efficiency of gas-fires, the old prejudice against them had gone; and his Committee were of opinion that it would be a great convenience to consumers if central show-rooms were provided for the exhibition of all kinds of appliances. In the past, the Corporation had made very limited use of their powers to fix gas apparatus; and while they did not wish to unduly increase them in the future, they desired to be in a position to exercise greater supervision of the appliances they let out, and to render more assistance to consumers than was the case at present. He emphasized the point that there was no desire by the Gas Department to encroach on the plumbing trade of the town. On the contrary, they wanted the plumbers to co-operate. The minutes, including a resolution for the payment of the Corporation's subscription to the British Commercial Gas Association, were approved.

Dangers of Electricity.—Just before half-past nine o'clock last Wednesday night, an outbreak of fire occurred in a flat on the upper floors of the premises occupied by Messrs. Mortlocks, Limited, china and glass manufacturers, in Oxford Street, W. The third and fourth floors were half burnt out, and part of the roof was destroyed. The fire is supposed to have been caused by a defective electric circuit. To the fusing of cables is thought to have been due a fire which caused much damage to stock at the large drapery establishment of Messrs. Harvey, Nichols, and Co., Limited, at Knightsbridge, S.W.

Penal Servitude for a Prepayment Meter Thief.—Thefts of the money-boxes and contents from prepayment meters in dwelling-houses (which were entered through the cellar grating) had become somewhat prevalent in Derby; but it is stated that they practically ceased after the arrest of Samuel Radford, a joiner. At the Borough Quarter Sessions, a few days ago, Radford was indicted for breaking into three houses, and stealing the money-boxes of the gas-meters. Evidence of a convincing character was submitted; and, in spite of his denials on oath, the prisoner was found guilty. His previous convictions—one being for sacrilege—numbered five; and he was sentenced to three years' penal servitude.

Price of Gas at Ellesmere Port.—An agitation has been in progress at Ellesmere Port (Cheshire), which depends upon the Shropshire Union Railways and Canal Company for its gas supply, with a view to securing a reduction in price. Two years ago, the Urban District Council petitioned the Company, at the request of a ratepayers' meeting, to this end; and various concessions have now been granted. Mr. E. Whitham (the General Manager of the Company) has written to the Council stating that a reduction of 3d. per 1000 cubic feet to ordinary consumers had been decided on; the quantity supplied through prepayment meters to be increased by 4 cubic feet. Quarterly meter rentals are reduced; and the Company offer, on certain conditions, to refund to individual customers of not less than three years' standing, who can show that they are entitled thereto, any cash deposits, without interest, which may have been paid. The concessions took effect on the 1st inst.

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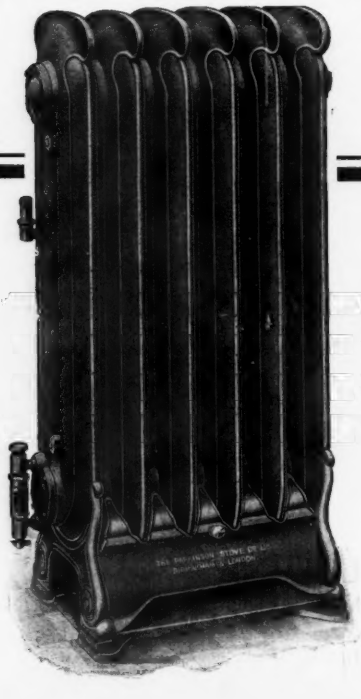

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As from the 1st inst., the business of Norden's and General Incandescent Company, Limited, has been transferred to the New Sunlight Incandescent Company (1900), Limited, of No. 344, Gray's Inn Road, King's Cross, W.C.

Mr. Frederick George Larrad, an elderly clerk in the employ of a West Riding firm of worsted spinners, has for years made a hobby of mechanics. His house at Horbury, near Wakefield, is a veritable foundry. He has recently lighted the whole of it by electricity; his dynamo being driven by a compact little gas-engine which he has constructed at home, working his metals by the aid of a home-made furnace. Though he has never had a lesson in mechanics, he claims to be something of an expert on gas-engines.

At the next meeting of the Salford Town Council, Mr. F. Steele will move that gas-cookers be supplied free within the borough.

The warrants for the dividend on the preference shares of the Richmond Gas Stove and Meter Company, Limited, for the half year to the 31st ult., and for the interest on debenture stock for the same period, have been posted.

Last Wednesday evening, about seven o'clock, there was an extinction of all the electric lights in the neighbourhood of Knight's Hill, Norwood, due to a damaged cable, through which water percolated. The ground had to be opened in several places before the mischief could be located, and the main cable repaired in more than one section before the current was usable. No little inconvenience was caused.

GAS COMPANIES' STOCK AND SHARE LIST.

Last week was but a patchwork period on the Stock Exchange, combining the last days of the Old Year, the first days of the New Year, and a holiday gap in between. The general tone from time to time was as variable; the market weathercock veering or backing fitfully. The Conference game going on at St. James's was more puzzling than ever; and the sharpest eyes could not spot which thimble the peace was under. When the markets opened on Monday, they might as well have been closed but for the winding-up of the settlement. Not one could raise any interest; and they all shrank when touched. Government issues weakened. Rails were inanimate, and Americans depressed. With the closing of the settlement and of the year on Tuesday, business was very quiet. But the tone caught the orthodox seasonable temperament, and was quite cheerful. Gilt-edged were very firm, and Consols rose ¼. Some Rails advanced their prices, Americans were stronger, and Foreign in good case. On Thursday, the New Year opened with quite a flourish, determined to see the bright side of everything. All markets improved. Consols rose ⅛, Rails advanced well, and the rest generally were better. But things gave way on Friday, with uneasiness as to Balkan affairs and lack of support from buyers. Consols lost ⅛, Rails moved unevenly, and Americans were irregular. Somewhat oddly, the Foreign was about the steadiest market. Saturday was quiet, with a dull tendency. Consols fell another ⅛, closing at 75 to 75¼—a gain of ⅛ in the week. In the Money Market, there was a very strong inquiry up to the close of the year; but with the turn came a slackened demand and an abundant supply. Discount was firm. Business in the Gas Market was only moderate, and was devoid of any special feature. In Gaslight and Coke issues, the ordinary was very steady. One small lot was done specially at 105⅛; but all the other transactions were between 105⅜ and 106⅛. In the secured issues, the maximum marked from 84 to 85, the preference 101 and 101¾, and the debenture 76 and 77. South Metropolitan was quiet and unchanged, realizing prices from 117 to 117⅛. The debenture changed hands at 78. In Commercials, there was only one transaction in the debenture at 72. Among the Suburban and Provincial group, the only issues dealt in were South Suburban at 119 and 120, Tottenham "B" at 116½ and 117, and Lea Bridge at 123½ and 124. In the Continental companies, Imperial was dealt in at 175½ to 178, ditto debenture at 86⅜ special, Union preference at 130¼, European at 19 and 19¾, and Tuscan debenture at 96½. Among the undertakings of the remoter world, Bombay realized 6⅝, Buenos Ayres debenture 93¼, Cape Town debenture 74, Monte Video 12½, Primitiva 6 7/16 and 6⅝, ditto preference from 5 1/16 to 5 3/16, and ditto debenture 97½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment. £ s. d.
£			p.c.				
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	73—78	..	6 8 2
374,000	,,	July 12	4	Do. 4 p.c. Deb.	83—86	−5½	4 13 0
250,000	5	Oct. 11	7½	Bombay, Ltd.	6½—7	..	5 7 2
50,000	10	Aug. 29	15	Bourne- \ 10 p.c.	29—30	..	5 0 0
332,000	10	,,	7	mouth Gas - B 7 p.c.	15⅝—16¼	..	4 6 2
75,000	10	,,	6	and Water / Pref. 6 p.c.	14—14¼	..	4 2 9
380,000	Stk.	Aug. 14	13½	Brentford Consolidated	257—262	..	5 3 1
330,000	,,	,,	10⅝	Do. New	198—203	..	5 3 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	116—118	..	4 4 9
206,250	,,	Dec. 12	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
218,230	Stk.	Aug. 29	11	Brighton & Hove Orig.	210—215	..	5 2 4
244,200	,,	,,	8	Do. A Ord. Stk.	152—155	..	5 3 3
580,000	20	Sept. 27	12½	British	44½—45½	..	5 9 11
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89—91*	..	4 7 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	92—94*	..	4 5 1
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
150,000	10	—	—	Do. 4½ p.c. Pref.	3½—4½	..	—
100,900	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	71—75*	..	6 0 0
157,150	Stk.	Aug. 29	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Pref.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	102—104	..	5 2 6
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	83—86	..	4 13 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—132	..	5 6 1
492,270	Stk.	—	5¾	Derby Con. Stk.	124—125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
1,002,180	10	July 26	10	European, Ltd.	19—20	..	5 0 0
16,160,600	Stk.	Aug. 14	4/17/4	Gas \ 4 p.c. Ord.	105—107	..	4 11 0
2,600,000	,,	,,	3½	light / 3½ p.c. max.	82—85	..	4 2 4
4,062,235	,,	,,	4	and \ 4 p.c. Con. Pref.	100—102	..	3 18 5
4,531,705	,,	Dec. 12	3	Coke / 3 p.c. Con. Deb.	75—77	..	3 17 11
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	91—93	..	5 7 6
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	16—16½	..	6 13 4
131,000	Stk.	Sept. 13	7⅜	Ilford A and C	154—157	..	4 17 1
65,780	,,	,,	6½	Do. B	121—123	..	4 19 7
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89—91*	..	4 7 11
4,940,060	Stk.	Nov. 14	9	Imperial Continental	175—178	..	5 1 1
1,235,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	86—88	..	3 19 7
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	122—125	..	4 16 0
561,000	Stk.	Aug. 29	10	Liverpool United A	223—225	..	4 8 11
718,100	,,	,,	7	Do. B	161—163	..	4 5 11
306,083	,,	Dec. 30	4	Do. Deb. Stk.	98—100*	..	4 0 0
63,480	Stk.	June 28	3	Maidstone 3 p.c. Deb.	69—71	..	4 4 6
75,000	5	Nov. 28	6	Malta & Mediterranean	4½—4¾	..	6 6 4
250,000	100	Oct. 1	4½	Met. of Melbourne \ 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	Oct. 30	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	July 26	4¾	Newc'tle&G'tesh'd Con.	99½—100½	..	4 7 1
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	85½—86½*	..	4 0 11
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.	13½—14½	..	5 1 5
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	125—130	..	6 3 1
60,000	5	Sept. 27	10	Ottoman, Ltd.	8¼—8¾	..	5 14 3
60,000	50	Aug. 14	13	Portsea, Island B	127—130	..	5 0 0
100,000	50	,,	12	Do. C	124—127	..	4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.	6¼—6⅜	..	5 18 6
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	5—5¼*	+⅛	4 15 3
521,600	100	Dec. 2	4	,, 4 p.c. Deb.	96—98	..	4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92—94*	..	4 5 1
275,000	5	Apl. 12	12	San Paulo, Ltd.	13—14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	48—50*	+½	5 0 0
135,000	Stk.	Aug. 29	10	Sheffield A	231—233	..	4 5 10
209,984	,,	,,	10	Do. B	230—232	..	4 6 2
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
90,000	10	Sept. 27	7½	South African	9¼—10¼	..	7 2 10
6,429,895	Stk.	Aug. 29	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	76—79	..	3 15 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	163—165	..	5 3 0
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 16 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—119	..	4 4 0
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	118—120*	+½	4 3 4
594,740	Stk.	Nov. 14	5	Southampton Ord.	102—105	..	4 15 3
120,000	Stk.	Aug. 14	7½	Tottenham \ A 5 p.c.	142—145	..	5 0 0
483,940	,,	,,	5½	and / B 3½ p.c.	115—117	..	4 18 3
149,470	,,	Dec. 30	4	Edmonton \ 4 p.c. Deb.	92—94*	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	8—8½*	..	5 17 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	95½—97½*	+1	5 2 7
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	115—115½	..	4 6 7
255,636	Stk.	Aug. 29	6⅞	Wands- \ B 3½ p.c.	139—142	..	4 16 10
85,766	,,	Dec. 30	3	worth / 3 p.c. Deb. Stk.	68—70*	− ½	4 5 9

Prices Marked * are "Ex. Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

CHIEF ASSISTANT ENGINEER. Staffordshire Potteries Water-Works Company. Applications by Jan. 20.
MANAGER (Coke Oven Works). No. 5683.
DRAUGHTSMAN. R. & J. Dempster, Limited, Manchester.
DRAUGHTSMEN Ashmore, Benson, Pease, and Co.
DISTRICT AGENT AND CANVASSER. Tynemouth Gas Company.
OUTDOOR INSPECTOR. Aberdare and Aberaman Gas Company.
ASSISTANT (Gas Apparatus Manufacturers). No. 5681.
FITTER. No. 5680.
JUNIOR CLERK. Sheppy Gas Company.

Appointments, &c., Wanted.

LEADBURNER AND CHEMICAL PLUMBER. No. 5673.
ASSISTANT OR WORKS MANAGER. No. 5682.

Plant, &c. (Second-Hand), for Sale.

CENTRE VALVE FOR PURIFIERS. Devizes Gas-Works.

Stocks and Shares.

DORKING GAS COMPANY. By Auction. London Mart. Jan. 21.
GREAT YARMOUTH WATER COMPANY. By Auction. London Mart. Jan. 21.
HOUGHTON-LE-SPRING GAS COMPANY. By Tender. Jan. 14.
SHERINGHAM GAS AND WATER COMPANY. By Auction. London Mart. Jan. 21.
SOUTH WEST SUBURBAN WATER COMPANY. By Auction. London Mart. Jan. 21.
SOUTHEND WATER COMPANY. By Auction. London Mart. Jan. 21.

Meeting.

COMMERCIAL GAS COMPANY. Cannon Street Hotel. Feb. 20. Twelve o'clock.

TENDERS FOR

Coal.
COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 11.

Condenser.
WARRINGTON GAS DEPARTMENT.

General Stores (Paint, Putty, White Lead, Glass, and Tin Plates).
CALCUTTA CORPORATION. Tenders by Feb. 10.

Glass Cylinders.
CALCUTTA CORPORATION. Tenders by Feb. 10.

Pressure Raiser.
WARRINGTON GAS DEPARTMENT.

Tar Still.
WARRINGTON GAS DEPARTMENT.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1913, are reminded that this can only be done during the current month.

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